Nature Magazine

VOLUME 46 NUMBER 1

JANUARY, 1953

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Nature in Print

By HOWARD ZAHNISER

WHAT a joy it is, after a period of bright weather, to sit at home on a rainy Saturday, with a couple of books like Edwin Way Teale's *Green Treasury* and N. J. Berrill's *Journey into Wonder*. Both of them range far, yet both of them are of and for the library. Neither of them disturbs the cosiness of the indoors in inclement weather, the sheltered enjoyment of rain soaking the earth after drought, yet both take the reader on great journeys through time and space. Dr. Berrill's *Journey into Wonder* is described on its jacket as "the story of man's discovery of the natural world around us," and Mr. Teale's *Green Treasury* is subtitled *A Journey Through the World's Great Writing*. Having read them both, one can browse through them, contemplate them before an open fire, in an armchair, with deep satisfaction, and realize what a pleasure they can bring to other readers who are interested in the discoverers who have been naturalists and in the writers who, as Mr. Teale says, have been "setting down the mysteries observed, the feelings engendered, the thoughts evoked, by contact with many-faceted nature."

Starting with Christopher Columbus, Dr. Berrill has retold the experiences and discoveries of the voyagers who have extended man's knowledge of his earth. John Hawkins, Francis Drake, Richard Hawkins, William Dampier, Georg Forster, Alexander von Humboldt, Charles Darwin, Sir Robert Falcon Scott — these are the explorers whose journeys Dr. Berrill retraces, these and other heroes who have gone into the polar regions and others who have been exploring into the archeological past and into the future. It is not merely a retelling of the adventures of these explorers that interests Dr. Berrill, for his interest is in natural history and in what he can see through the eyes of the men of whom he writes, the spectacle of life that they beheld fresh and new, and which before them was unheard of or little known. His book is as satisfying as it is interesting, his interest thus in natural history providing as pleasant a retelling as one could imagine for the tales of discovery that we like to hear over and over, and the excitement of observation of these explorers providing the best of atmospheres for the accounts of natural history.

"Each voyager," Dr. Berrill writes on an early page, "has been a naturalist, for one reason or another, and it is as a naturalist that I can see through their eyes the changing world that they record, change which in part has come from impact of the voyages themselves and partly from the changing minds of the successive observers."

"As a naturalist concerned with the sea and the land and the planets as abodes of life," continues Dr. Berrill (who is a marine biologist, a professor of zoology at McGill University in Montreal, Canada), "I find my own beginnings early in this story. The living universe which I and my generation see in this, our time, is something that has grown from a tale of high adventure, and this book is written for the enjoyment of reliving the gradual discovery of a new world."

It is the "unfolding knowledge of living things" that is the real central theme of this *Journey into Wonder*, knowledge that is still to be increased. The work is thus not only information but inspiration. "The world," says our author, "shrinks, gets too well explored, yet still the wonder grows," and what is left, as Dr. Berrill sees it, is "all that is wonderful, if we have the sense to see it."

Journey into Wonder will indeed help us to have the sense to see it. And so also will Edwin Way Teale's newest contribution to our always rewarding shelf of his Nature writings. For although this is a collection of writings by some eighty-nine other authors, as well as his own, it is assuredly an original contribution at the same time. The hundred and eighty-one selections are not only prefaced by Teale comments, but they also are his selections, choices made with a great literate vitality, and they are arranged in a sequence that contributes to the reader Mr. Teale's sense of order. Made up of the best of writings from many writers, the work nonetheless has the unity of a mosaic that is itself a work of originality. Few, I assume, are those who will read its more than 600 full pages continuously as have I, yet I am sure that all who do will find the unity of the experience rewarding — and the subsequent browsings and readings all the more profitable. As a source of occasional readings this book is certainly superb — an excellent volume to have at hand.

"In recent years," Mr. Teale comments in his introduction, "nature writers have become increasingly concerned with presenting the complete picture, the rounded whole," and he himself has shown in *Green Treasury* his own concern with the rounded whole. Opening with a sequence of twenty-two selections grouped under the heading "The Waters," he continues with four other similar groupings called "The Land," "The Sky," "Night and Day," and "The Seasons." Then there follow a half dozen sequences of selected writings on "the life of the earth"—plants, animals, reptiles, insects, and birds, and finally as the climax of this great book a sequence of thirteen selections on "The Life of the Earth: Man and Nature." Thus is achieved the unity of the volume.

Mr. Teale's comments on the various selections are informative and introductory in the very best manner, not exhaustive but interesting and nicely apropos of the writing that follows. What an excellent toastmaster he would be! His own dissertation, the introduction to the volume with the note that precedes it, is a stimulating and revealing essay on Nature writing and the Nature writers. "These men," he points out, "varied in innumerable ways — Walton the ironmonger, White the clergyman, Bartram the plant-hunter. Some stayed at home like Fabre and Thoreau; some ranged over the face of the earth like Humboldt and Darwin and Wallace. Some died young like Jefferies and Farrer; some lived to be octogenarians like Burroughs and Hudson." Yet seeking "the common denominators that run through all the greatest writers in the field," Mr. Teale sees that "through the lives of all ran the grand passion of their love of nature for its own sake."

It is interesting to note that Mr. Teale has found that the "vast bulk" of the world's great writings on Nature have been written where English is spoken, where this "grand passion," this "love of nature for its own sake," has been characteristic. "Elsewhere," he has noted, "a surprisingly large proportion of the writing about the out-of-doors is confined to the chase, to hunting, to dangerous encounters, to nature ferocious," but in our own land and our own language we have most characteristically expressed a "fellow feeling for all the natural world," looking on man as "a part rather than a spectator of the great parade of life." "Nature writing, as we understand it today," Mr. Teale comments, "is the product of very recent generations

Great Miracles

By JOHN GALLINARI WHIDDING

I watch the seeking ants that pass
Within the forest of the grass,
Pausing to gain a moment's shade
Behind a topless sky-tipped blade,
Or meeting unexpected grief
By tumbling from a clover-leaf.

I follow with my lazy eyes
The graceful orange butterflies
That like a band of angels hover
Above the white and purple clover —
Wheeling, gliding, falling, rising
Upon their nervous enterprising.

Man need not know the nomenclature
Of all the trivia of nature
To sense in ant and gnat and midge
His manifested privilege
To share the sun, the sky, the sod
With these great miracles of God.

and it has reached its highest development and its greatest popularity in English-speaking lands."

Mr. Teale's selections are well made with respect to their own integrity, not made to conform to arbitrary requirements of the anthologist or publisher, so far as one can see. They vary in length from a sentence to sixteen pages, and an author is represented repeatedly if this seems appropriate. From the writings of Thoreau, Mr. Teale has presented us an entire dozen of selections, from those of W. H. Hudson eight, and from John Burroughs's writings seven. Nor are only the popularly designated Nature writers represented here. In fact, the most frequently quoted writer after these three great leaders is the novelist Thomas Hardy, from whom we have here a half-dozen selections. Writers quoted five times are Richard Jefferies, Donald Culross Peattie, and Gilbert White. William Bartram, Joseph Conrad, Charles Darwin, Fiona Macleod, and Walt Whitman (in prose only) are here four times each.

Such are the interesting observations that one is led into as he contemplates a work of this kind, for expressing an appropriate appreciation of such a volume in the compass of a brief essay is something that leads into these details or into generalizations. I hardly know whether I have enjoyed more in this volume the rereading of familiar writings or the occasional discoveries of those not before known, although I feel certain that my enjoyment of the unity that Mr. Teale has achieved in his composition of the volume has been greater than either. Some enjoyments have been perhaps casual — noting, for example, in a selection from Thomas Hardy's *The Return of the Native*, which I have read and reread, the emphasis, fresh at this reading, on the modern importance of the wild in Nature as compared with the lovely:

"The new Vale of Tempe," it reads, "may be a gaunt waste in Thule: human souls may find themselves in closer and closer harmony with external things wearing a sombreness distasteful to our race when it was young. The time seems near, if it has not actually arrived, when the chastened sublimity of a moor, a sea, or a mountain will be all of nature that is absolutely in keeping with the moods of the more thinking among mankind. And ultimately, to the commonest tourist, spots like Iceland may become what the vineyards and the myrtle-gardens of South Europe are to him now; and Heidelberg and Baden be passed unheeded as he hastens from the Alps to the sand-dunes of Scheveningen."

It is interesting to note again Thoreau's observation a century ago on "how base or coarse are the motives which commonly carry men into the wilderness," his protest that the men who go into the woods were hirelings with "no more love for wild nature than wood-sawyers have for forests," and his fervent question: "But, pray, could not one spend some weeks or years in the solitude of this vast wilderness with . . . employments perfectly sweet and innocent and ennobling?" Then in the final pages of *Green Treasury* one reads Aldo Leopold's facing of "the question whether a still higher 'standard of living' is worth its cost in things natural, wild, and free," and on the following page to read Thoreau again, assuring us that "we need the tonic of wildness," that "we never can have enough of nature," is to feel that these journeys (even in books indoors in the cosy shelter from Saturday rain) are excursions into the realms of our best existence.

Green Treasury: A Journey through the World's Great Nature Writing. With an Introduction and Interpretive Comments by Edwin Way Teale. New York: Dodd, Mead & Co. 1952. 615 pp. (5¾ by 8⅝ in.), with decorative endpapers and 11 drawings by Michael H. Bevans, index of authors, and annotated list of the books of Edwin Way Teale. $5.

Journey into Wonder. By N. J. Berrill. New York: Dodd, Mead & Co. 1952. 338 pp. (5¾ by 8½ in.), with 27 drawings by the author and index. $4.

Near Shore

Life of the Shore and Shallow Sea. By Douglas P. Wilson. New York. 1952. The McBride Co. 213 pages. Illustrated. $3.95.

The author writes of the life of the seashore and its immediately contiguous waters of the Continental Shelf. It is an authoritative yet not highly technical discussion.

Capri

Footnote on Capri. By Norman Douglas. New York. 1952. The McBride Co. 46 pages, plus forty-eight photographs by Islay Lyons. $2.75.

Anyone who has visited lovely Capri will delight in this description of it and the beautiful pictures that will bring back memories of that visit.

Other Audubonia

Audubon's Butterflies, Moths and Other Studies. Complied and edited by Alice Ford. New York. 1952. Studio-Crowell. 120 pages. Illustrated by reproductions in monochrome and color of Audubon's sketches of insects and reptiles. $5.75.

People rarely think of John James Audubon except in relation to his bird pictures and his association with early bird study in America. Other forms of wildlife, however, interested the great artist and his sketches of various insects and some reptiles have never before been reproduced. Audubon pioneered, indeed, with such studies when there was little reference material about them. The author, who also edited *Audubon's Animals*, provides an interesting accompanying text, drawing upon the artist's journals for references to the forms of life covered in this book. This is a fine addition to Audubonia.

NATURE MAGAZINE

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To Stimulate Public Interest in Every Phase of Nature and the Out-Of-Doors, and Devoted to the Practical Conservation of the Great Natural Resources of America

IN THIS ISSUE

January, 1953 Vol. 46, No. 1

NATURE MAGAZINE is published monthly, October to May, inclusive, bimonthly, June to September, inclusive, by the American Nature Association. Entered as second-class matter May 31, 1927, at the post office at Washington, D. C., U. S. A., and accepted for mailing purposes at the special flat rate of postage provided for in the United States Postal Act of October 3, 1917, and February 28, 1925. $4 a year; foreign, $5.00. Additional entry Easton, Pa.

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British Mammals

British Mammals. By L. Harrison Matthews. New York. 1952. The British Book Centre. 410 pages. Illustrated in color and black and white. $5.50.

This is regarded as the most important book on the mammals of Britain ever published. This author is a naturalist of distinction and wide experience and he approaches his subject as a mammalogist. However, it is a popular discussion, bringing together all the results of research on British mammals, which have been neglected in comparison to the attention given in books and periodicals to, for example, Britain's avifauna.

The Potomac Valley

"The Potomac Valley: History and Prospect" is the title of an extremely interesting and valuable 44-page booklet that deals with the valley of this historic river and its watershed from the standpoint of the naturalist and conservationist. John Ely Briggs discusses the coming of man to the valley and the impact of the early tobacco economy, followed by wheat growing, upon the soil. He traces this interesting history in a compactly written introductory chapter. Bernard Frank draws the picture of the Potomac watershed today, and Walter Slavik and Francis M. Uhler collaborate to discuss the past and present of migratory waterfowl in the Potomac waters. Edward N. Munns takes a look to the future, based upon what is done or not done to change the existing pollution and abuse of the Potomac. This is emphasized from the point of view of restoration in a final chapter by Irston R. Barnes, economist and president of the Audubon Society of the District of Columbia, to which organization we are indebted for this publication. Copies are available at 75 cents from the Audubon Society of the District of Columbia, Box 202, Benjamin Franklin Station, Washington 4, D.C.

Good Manners

Sing A Song of Manners. By Marion Jollison. New York. 1952. Hart Publishing Co. 64 pages. Illustrated by Bernice Myers. $2.00.

The author and the illustrator in this book have collaborated to create a number of boy and girl characters — boys like "Helpful Henry" or "Selfish Sam"; girls like "Messie Bessie" or "Sociable Sue." Then, in rhyme that will be enjoyed by youngsters from five to 9, lessons in good manners are presented. We can see where the characters would become so alive to the young readers that they would wish to associate themselves with the nice ones and avoid being like the ones that are not so nice. This is a novel way of getting over ideas without moralizing.

Games

Dictionary of Games. By J. B. Pick. New York. 1952. The Philosophical Library. 318 pages. $4.75.

This book contains instructions on how to play 458 games, both indoor and outdoor. It was compiled by a Briton and first published in Britain. His description of how baseball is played is delightful — "glorified rounders or an extraordinary American war-dance performed in knickerbockers."

Dictionary of History

The New Dictionary of American History. By Michael Martin and Leonard Gelber. New York. 1952. The Philosophical Library. 695 pages. $10.00.

This reference work about individuals and events in American history, from Abbe, Cleveland, to Zenger, Peter, is a valuable volume to have around. About 1300 biographies are included in the more than 4000 articles, alphabetically arranged.

Photogrammetrists Meet

A panel on "Arctic Mapping" and a full day devoted to "Photo Interpretation" will be among the highlights of the Nineteenth Annual Meeting of the American Society of Photogrammetry to be held at the Shoreham Hotel, Washington, D.C., January 14 to 16. There will be exhibits and displays of maps and camera and photogrammetric equipment.

From Hawaii

Several interesting and attractive publications come to hand from the Hawaii Natural History Association, Hawaii National Park, Hawaii. "Volcanoes of Hawaii National Park" is a 44-page, illustrated booklet by Gordon A. MacDonald and Douglass H. Hubbard, price fifty cents. "Trailside Plants of Hawaii National Park," a 30-page, illustrated pamphlet by Mr. Hubbard and Vernon R. Bender, Jr., sells for twenty-five cents. "The Legend of the Naha Stone" is a twenty-five cent pamphlet translated by Rev. Stephen Desha, Sr., and adapted by L. W. de Vis-Norton. There are also two booklets that describe what one sees along the self-guiding Nature trails at Kipuka Puaulu — Bird Park — and along Halemaumau Trail — "The World's Weirdest Walk."

Marine Game Fishes

Marine Game Fishes of the World. By Francesca La Monte. New York. 1952. Doubleday and Co. 190 pages. Illustrated, with 80 drawings in full color and 58 in black and white, by Janet Roemhild. $3.50.

This splendid guide to the game fishes of the oceans provides both identification information and data on the angling methods used to catch each fish and the commercial significance of the species.

The upper side is black with a blotch of blue.

On the Trail of A Butterfly

The under side is marked in a soft grayish-brown.

By CLARA DENISON LOOMIS

Photographs from the British Museum

IN THE world's largest natural history museums are great cabinets, redolent of naphthalene, in which are stored butterflies that have been gathered from the ends of the earth. Among them may be a rare species measuring half an inch in length and with a wing spread of one and one-quarter inches. The upper-side of each wing is black with a blotch of bright blue, and on the underside are markings in a soft grayish-brown. This butterfly is now numbered among Japan's national treasures, and this is how it was discovered.

In the summer of 1887 my father, Henry Loomis, of Yokohama, was spending long weekends with his family in Kanozan, a small village in the hills overlooking Tokyo Bay. Through Mr. H.J.S. Pryer, an English naturalist, also a Yokohama resident, Mr. Loomis had acquired an interest in collecting butterflies and moths. With the cooperation of us children, and of the small boys of the neighborhood as well, he acquired perhaps the world's largest collection of Japan's butterflies and moths, and was in touch with the naturalists of many lands.

One windy day, my father started out alone and came home quite excited over his catch of a butterfly that he had never seen before. At the first opportunity he took it to his friend, Mr. Pryer, for identification, found it was a new species and at the suggestion of Mr. Pryer it was in time classified by the Smithsonian Institute in Washington, under the name of *Amblypodia loomisi*.

Thirty-five years later I was spending ten days in London and dropped into a little shop near the British Museum, to get one of the little trinkets, made of butterfly wings, on display in the window. When the shopkeeper, Mr. Mason, came up I remarked: "This place takes me back to old times. It smells just like my father's butterfly-room." He asked father's name and when I told him he said: "That is a well-known name here. Your father had a wonderful collection." Mr. Mason then inquired whether I knew of a Mr. Pryer, a classmate and intimate friend of his father, and one who had spent many years in Japan. I told him that it was Mr. Pryer who inspired my father and on his death had left him the beautiful English cabinets that had been imported for his collection. Mr. Mason then told me that his father also had one of these cabinets. When I asked Mr. Mason whether he knew of the *Amblypodia loomisi*, which Mr. Pryer had named, he said, "Yes, I believe there are some specimens in the Victoria and Albert Museum." There, indeed, I found them.

Shortly after my return to Japan I was invited to an exhibit of beetles, grasshoppers, moths and butterflies, which had been collected during the summer by some Japanese Boy Scouts. In the collection I discovered an *Amblypodia loomisi* with its black-edged, bright blue wings. I found my friend, the earnest little Boy Scout leader, much interested in the story I told him of its discovery in the hills of Kanozan.

Again, in 1910, I ran across the tiny creature when making a study of the birds and mammals of Japan in the library of the Imperial University in Kyoto. A Japanese book on insect life showed a scale drawing and description of "my butterfly," and an octavo publication in English told of its discovery and stated that the only place where the *Amblypodia loomisi* was found was on Kasuga, a wooded hill on the outskirts of Nara, Japan's ancient capital. It had attracted so many collectors from far and wide that it was now guarded to prevent extinction.

The *Amblypodia loomisi*, unlike most butterflies, lives in the woods and is not attracted by flowers or running water. Its flight is rapid but it does not fly long distances, according to information from Mr. Pryer.

Vignette

By GERHARD FRIEDRICH

Out of the thicket they broke, intense in their fury,
Two stately bucks let loose by the soft-scented twilight,
Charging each other until, interlocking their antlers,
They madly pushed past me, and over the thin strip of beach,
And into the water, and deeper and ever deeper,
Contending for what they must then have all but forgotten,
Contending — until by a sudden, weird, gurgling misfortune
The contestants had vanished. The lake lay in motherly quiet,
Reflecting the prayerful trees and a sprinkling of stars.

Contents Noted

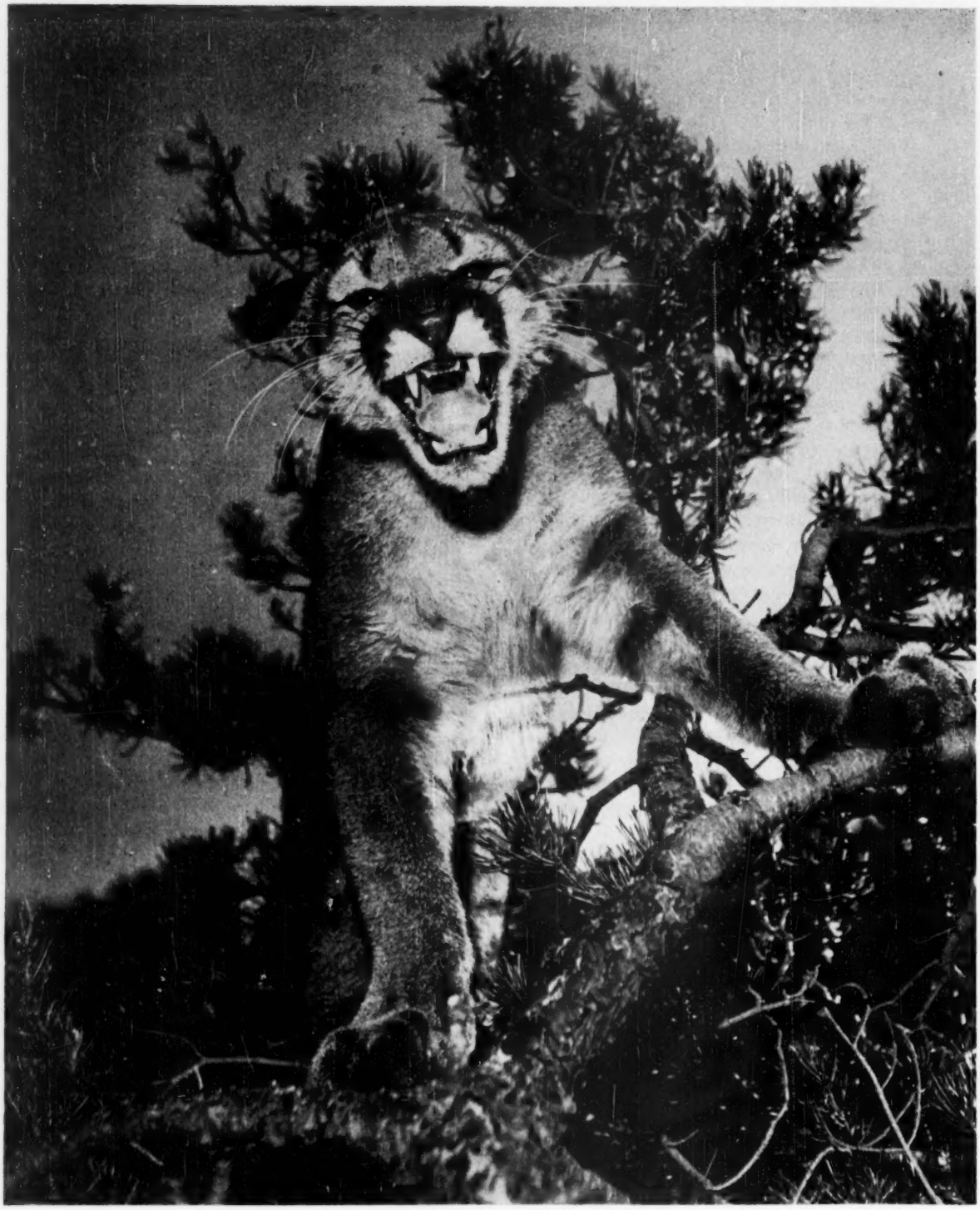
MANY requests for information come to our desk in the course of the year. Other letters seek answers to questions, some of them unanswerable and some that would require a volume to answer. Among these inquiries there is a disturbing number that suggest that the inquirer never heard of a public library. This is disturbing because it reveals a widespread laziness of mind and disinclination to ferret things out, or a complete ignorance of where to turn to find information. Many of these inquiries come from school children whose teachers have given them a subject, and then turned them loose without a word of suggestion as to where to find material. But one recent inquiry is typical of too many that come from college students. We were asked to send "all information" about birds found in the United States, animals (sic) found in the United States, and trees found in the United States, and "how did the milk get inside the coconut?" We are less prone to criticize the student than the professor, whose basic responsibility is to teach students how to find and use sources of information.

TELEVISION, which we resisted until relatively recently, is, we must confess, a fascinating and insidious invention. It entertains, instructs and capitalizes on the human desire to see what is coming next. Television cuts into time for reading and threatens the art of conversation. It provides some pretty poor fare for the kids, and some that is imaginative, even valuable. In the year that we have indulged ourselves in televiewing — on occasion indulged too freely — it seems to us as though quality has been improving, in direct ratio to what we understand is the decline in the popularity of Milton Berle. This is an encouraging sign. And, we feel, when the television audience accepts and applauds such delightful half-hours as that provided by the gentle high school science teacher, "Mr. Peepers," the medium further demonstrates its possibilities in the direction of intelligent entertainment. We understand that the Ronald Colmans are to bring their "Halls of Ivy" to the television screen. That will be another forward step.

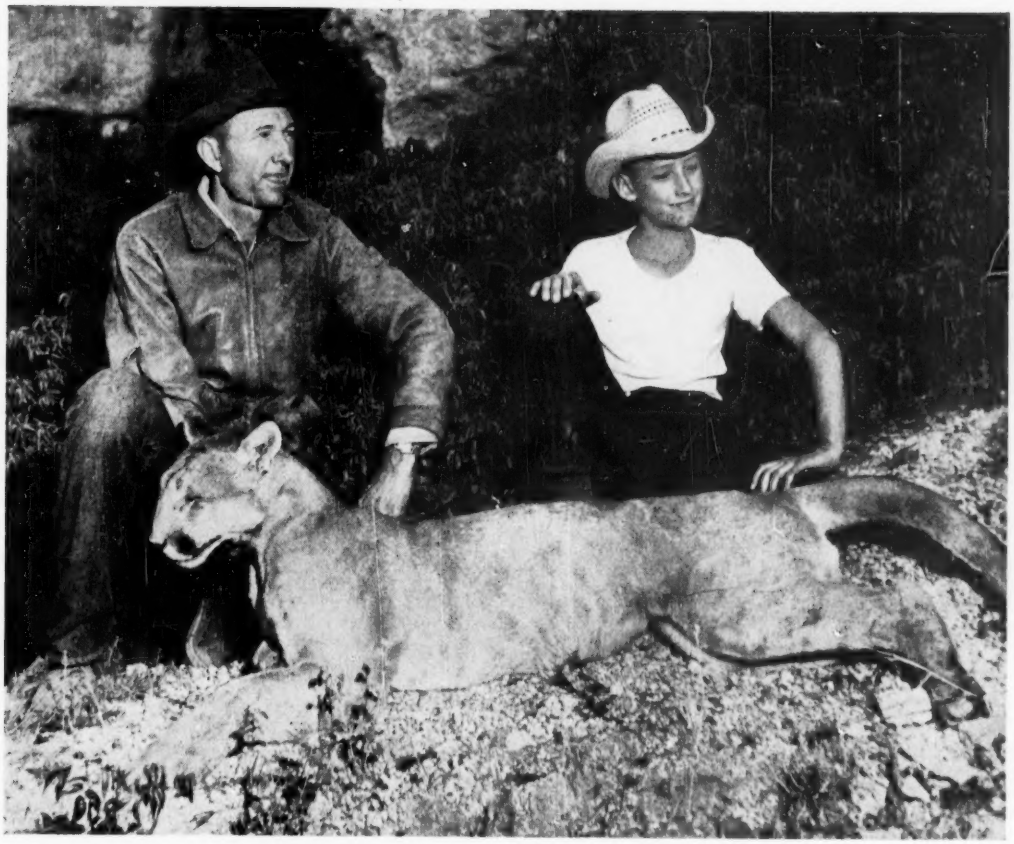
ANNOUNCEMENT of the selection of Governor McKay of Oregon as the Secretary of the Interior in the Cabinet of President-elect Eisenhower surprised the generality of conservationists. There seems ample evidence that the governor is able, a good administrator and informed to some extent on certain of the concerns of his department-to-be. Indeed, he is probably as well informed as most of his predecessors have been. Thus far news stories have largely been concerned with Mr. McKay's attitude toward public power as a Federal function, citing the Governor as a private power man, or States-righter, first. We have seen little to reveal his attitude toward the maintenance of the integrity of the National Parks, or his views, if any, on the important wildlife conservation responsibilities of the Department of the Interior. We have seen nothing to indicate whether he would stand with livestock interests in their moves toward grabbing grazing rights on public lands, or whether he will be aroused by the abuses of public property permitted under the present mining laws. Oregon's Governor is not stepping into any soft spot in the new administration's setup. An Associated Press story from Oregon's capital city, Salem, quoted the opinion of local newsmen specializing in politics as saying that Governor McKay tends to be thin-skinned and does not like criticism. He has until January 20 to develop an epidermis of more elephant-like texture. He could well need it, but we wish him success.

CITING Louis Bromfield's Malabar Farm in Ohio as demonstrating "a pattern for man's living in harmony with Nature on a sound ecological basis," Ludlow Griscom, chairman of the board of the National Audubon Society, presented Mr. Bromfield with the Society's Audubon Medal for distinguished service to conservation. Previous recipients of this award were Hugh Hammond Bennett, Ira N. Gabrielson and John D. Rockefeller, Jr. In his response Mr. Bromfield said: "Instead of a wasted and ruined countryside, crossed by polluted streams, devoid of wildlife or beauty, it is possible to make of the whole nation a vast and wonderful park in the midst of which lives and works man himself surrounded by a kind of natural paradise. All this is far less of a dream than it might appear. It is merely common sense. More than that, it is a plan that is profitable, not only in terms of dollars and cents but in a thousand other ways."

MARCH, 1953, promises to be a conservation month, what with the meeting of the North American Wildlife Conference, March 9 to 11, and the citizen's conference on conservation and development of natural resources, March 25 to 27, both in Washington, D.C. In between will come Wildlife Week, March 15 to 21. This observance is sponsored by the National Wildlife Federation, and this year will be devoted to the prairie chicken. Last year Wildlife Week highlighted the plight of the Key deer, and the program now is to devote the week each year to some species in dangerous condition. This grouse is found now only in fifteen states, nowhere in quantity, so a special study is sought to recommend action to save this chicken of the grasslands. Of course, less hunting occurs to us as a logical step, until we may be assured how much habitat is available to the prairie chicken and what it needs to survive. Perhaps Wildlife Week will serve to emphasize the need of such a course. — R.W.W.



". . . like him, or not, this big cat is a native American and deserves some rights as such. Called mountain lion, panther, puma, catamount, painter, and several other names, he is the most widespread of American land mammals, with a range stretching nearly 7000 miles from Patagonia to Canada."



Mountain lion hunters display one of the beautiful great cats. The youngster at the right appears particularly proud of this achievement.

The Case of the Cougar

By WELDON F. HEALD

Photographs by Tommy Lark from Western Ways.

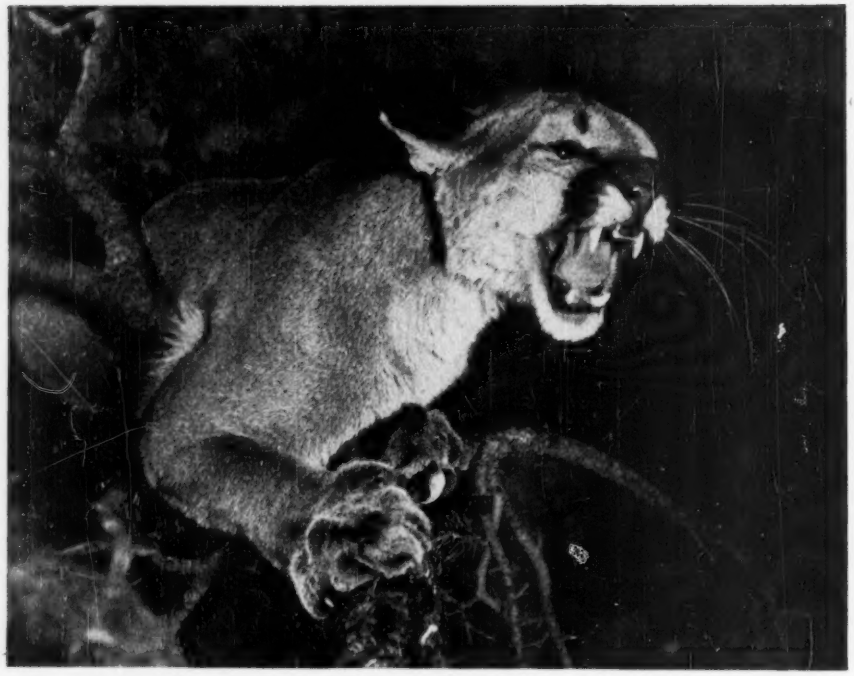
"MURDERER! ASSASSIN!"
"Fiendish, uncontrollable killer!"
"Gangster of the forests!"
"Cruel, savage, rapacious — "

Thus has the cougar been condemned at the bar of human justice, and the sentence pronounced. The verdict is complete extermination. *Death!*

But I charge a mistrial. I maintain that the cougar has been railroaded on trumped-up testimony, hearsay evidence, an intimidated jury and a bought judge. And, above all, I charge that the accused was never allowed witnesses or attorneys in his own defense. I brand such high-handed proceedings as improper, totalitarian and un-American. I ask that we review the cougar's case and demand a fair trial.

For, like him or not, this big cat is a native American and deserves some rights as such. Called mountain lion, panther, puma, catamount, painter and several other names, he is the most widespread of American land mammals, with a range stretching nearly 7000 miles from Patagonia to northern Canada. He has been a part of Nature's wildlife community since late Pliocene times, when man resembled the anthropoids more than the angels, and cougars almost identical to modern types were mired in California's tar pits 25,000 years ago. Nature is fond of this graceful, tawny carnivore and has nurtured him to her bosom — claws, fangs and all — for nearly a million years.

Why, then, has man suddenly reversed Nature's decision and declared the cougar Outlaw Number One? Why, after countless centuries of efficiently doing the job he was fitted to do, is this animal suddenly branded a berserk killer who menaces the very existence of every other creature that crawls, walks, runs or flies. Can it be that dumb, bungling Nature made an unfortunate mistake, which man, in his infinite wisdom,



A treed mountain lion snarls in understandable resentment at his persecutors on the ground below.

must rectify before this terrifying, blood-thirsty beast slaughters the entire American animal population?

No! Actually, the entire case against the cougar is precariously balanced upon the slender foundation of one recently manufactured scare-word. That word is *predator*, and all right-thinking men must shudder slightly whenever they hear it. Although all animal organisms have preyed upon each other since life first arose from the Cambrian ooze, being a predator today has become a heinous crime indeed. For, broadly defined, it is an animal that kills game that jealous humans derive pleasure in killing. The cougar is a skilled predator and therefore a rival of man, the greatest predator the earth has ever known. This is the unpardonable iniquity for which the cougar must pay with his life. All the other sins and misdeeds of which he is accused are so much eyewash of the sort that a good defense attorney could have thrown out of court as incompetent, irrelevant and immaterial.

Here is a typical sample of the hysterical denunciations and exaggerated absurdities hurled at the cougar.

"He is a dastard, a crook, a killer! He is vicious, savage and ruthless," shouts one well-known sportsman and writer. "The cougar does not kill for food alone. He kills to be killing, through unforgivable blood-lust. He is the enemy of all decent animals. Exterminate him!"

Note the high-flown moral fervor. It animates the whole tribe of cougar-haters. But it is pretty insecure ground. For, besides being ridiculous to judge wildlife from a morals point of view, it invites sober analysis. This so-called blood-lust is not common to the cougar alone — it runs through Nature and always has. I have seen a dog break the backs of two dozen chickens, and a couple of mules trample ten piglets to death. I know men who shoot rabbits, foxes and birds for sport from automobiles without stopping to gather them to eat, and I have heard a crowd roar with blood-lust at a bull-fight without afterwards dining on the bull. Several months ago my morning paper told me that an Egyptian mob tore a party of British limb from limb, and the same issue announced that our casualties in Korea had passed 100,000. From what lofty, unsullied realm does man look down and condemn Nature for her blood-lust?

But our author particularizes the cougar's crimes with two gruesome atrocity stories told him by a professional hunter. In neither case was he an eye-witness. These shockers, complete with bloody details of disembowelled deer or elk, are always brought forward as proof of the cougar's depraved villainy. "They indict this great outlaw cat and condemn him to punishment by death," the author concludes. This is the pathetic fallacy reduced to its ultimate absurdity.

However, I mention this particular writer, not to single him out, but because he is typical. He and hundreds of others have taken the witness stand and presented hearsay and indirect evidence against the cougar. Much of this originates with interested and prejudiced professional cougar hunters who make a good thing out of guiding parties, and, afterwards, collecting from $25 to $150 for every animal killed. Such second and third hand testimony would not be admissable evidence in any court of law, no matter how unimpeachable was the original source.

I do not inpugn the word of professional cougar hunters or enthusiastic sportsmen. I do not doubt they tell the truth. But I do know of many cases in which their original stories have become so garbled as to be unrecognizable after being retold by others. Cougar tales have a way of becoming embellished and exaggerated like legends, and the folklore of the far West is replete with stories of "Old Splayfoot," or "Old Ding Toe," the incredibly intelligent and crafty cougar who terrorized helpless ranchers for years, carrying off hundreds of head of livestock before being finally outwitted by some heroic hunter.

Also I do not question that upon occasion a cougar, like a man, will wantonly kill game beyond his needs.

However, I submit that it is not only unusual, but rare. In my twenty-eight years outdoor experience in the mountains of the eleven far western states I have never run into direct evidence of it. Yet, again and again, I have traversed cougar country, on trail and off, for periods of a few days to more than a month at a stretch.

Furthermore, simple statistics undermine the whole elaborate structure built up around the cougar's habitual wantonness. Cougar haters say that the big cat, "will kill as often as he gets a chance to kill," and one author tells of a cougar slaughtering seven elk in a day on Washington State's Olympic Peninsula. If this insatiable blood-lust was as general as he maintains, then twenty cougars — a modest estimate for the wilderness Olympic Mountains — could easily destroy the Roosevelt elk herd in fifty days flat. Certainly they could, at least, drastically reduce the cervine population. Instead, the direct opposite is true. The elk have increased in recent years to more than 7000 and could become a problem. The same situation applies in Arizona, a prime cougar State. There, 75 transplanted elk — which one lion could have eliminated in ten and a half working days, according to our author — have grown into a herd of 5000, and are now so numerous that they have become a bone of bitter contention between ranchers and sportsmen.

"A cougar averages a deer or an elk a week," says somebody.

"A mature mountain lion will kill as many as a hundred deer a year," says another.

"A cougar will slaughter 4000 deer during his lifetime, a reliable game warden told me," says a third.

"Many careful hunters say that the lion kills on the average of two deer each week the year round," wrote the late Colorado naturalist, Enos Mills.

Indirect evidence, hearsay testimony and conflicting statements again. Which one is true? Who said the first? What experts made the estimate for the second? What is the game warden's name and address? Who are Mills' careful hunters?

Nobody seems to know. And I need go no further than my own back yard in Arizona's Chiricahua Mountains to discover that not one of these statements can be proved. In fact, the more they are examined the less plausible they become. I live in fine white-tailed deer country, which is also one of the most famous mountain lion hunting areas in the United States. Last year seven cougars were killed in our valley alone, and the best well-informed guesses are that there will average about thirty stray, visiting and resident lions in the 200-square-mile area of the high Chiricahuas. In this same region are about 1500 white-tailed deer.

"Wait a minute," you say. "How can that be?"

Well may you ask. For, according to one of these statements, thirty lions would kill 1560 deer a year. Another raises the annual slaughter to 3120, and the third skyrockets the cougars' take to around 6000! And yet our deer, far from being a harrassed and terrified remnant of a once vast herd, thrive and multiply each year, in spite of cougars and human predators. During certain seasons you have to be careful not to run them down in your car, and there is direct evidence that the deer are becoming too numerous for the range to support them.

The truth is, of course, that deer and elk are not as easy prey as the cougar-haters would have us believe. They are fast, agile and alert and, particularly when full-grown, are no sitting ducks for Mr. Cougar. He can call it a lucky day when he pulls down his deer or elk, and he probably dines on venison about as often as you and I order a $3.50 restaurant steak. The day-by-day eating habits of the big cat are purposely suppressed, while his game killing is spotlighted in a bright glare of exaggeration. But every experienced outdoorsman knows that the cougar catches rats, mice, squirrels, rabbits and other small mammals, as well as birds. He considers porcupine a rare tidbit, but is not above taking grasshoppers, lizards, frogs and toads when the going gets tough. Enos Mills tells of following lion tracks in the snow for three days and found that, "during this time his entire food had been just one grouse."

Conditions in the Chiricahuas are neither local nor unique. Rather, they are typical of the mountainous areas of the far West where the tendency is an over-

Hunter and dogs look up at the treed puma, all eager for the kill of an animal that has been condemned without trial.

abundance of selective game beyond the capacity of the food supply. If the execution of the cougar and other so-called predators is successful, we will be faced with a seriously unbalanced condition of wildlife detrimental to vegetation, water supply, animals and humans. Furthermore, it starts a vicious circle with the smaller predators multiplying rapidly and becoming problems in their turn. Removal of the surplus game crop by additional hunting is put forward as "scientific game management." But this has proved to be a poor and uncertain substitute, and in no way solves the problem of the alarming increase of the smaller mammals that have become pests in many parts of the country.

The deer and elk population was never threatened with extinction before the white man came, neither are they now — even in lion-infested areas. But under former conditions the big cat acted as a brake to any species of animals getting out of hand, multiplying faster than the food supply, and upsetting the whole hair-trigger balance of Nature. Right now we are throwing the brake away and ordering full speed ahead. But it looks as if all the signals showed red.

What about the other count in the cougar's indictment — a propensity to share man's liking for beef, and an uncontrollable passion for horse meat? One author of a recent book on Arizona states that a rancher in the Huachuca Mountains told him that he lost 23 calves and yearlings in 1934 — "all chargeable to lions." "During the following year five more calves were said to have been slain by these big North American cats," adds the author. Note the "chargeable to" and the "said to have been" — the same kind of second hand, hearsay evidence we know so well. "The greatest delicacy, however, for the lion, is the colt," he continues, "and, as a result, it is practically impossible to raise a horse in these mountains".

Here, I will simply give my own *first hand* experience in the Huachuca Mountains, reinforced by others. For four years I raised cattle on an 8000-acre ranch that stretched from the foothills to the highest peak. During this period no cougar molested my calves or any other livestock, and I have the written statements of the former owner and of the man who bought the ranch from me two years ago, to the same effect. So here we have a continuous record of sixteen years raising some 2500 calves in notorious lion country without having one killed by cougars. Yet the north border of this ranch is only four miles air-line from the one where 28 calves were lost in two years — "all chargeable to lions." True, that was in 1934-35, but even the most confirmed cougar-haters stoutly maintain that the "varmints" are as numerous in the Huachucas today as they were forty years ago.

We raised horses successfully on the ranch, as all of our neighbors did also, and a couple of miles from us an Arabian horse stud farm operated for several years. In none of these cases was a colt killed by a cougar. But perhaps the longest authentic lion-free livestock record I have is that of the ranch east of us here in the Chiricahuas. In our valley, where seven cougars were killed last year and some thirty lions still roam, our neighbor has raised cattle and horses since 1902 without once losing a calf or colt that could be definitely chalked up against a cougar.

These two cases are not unusual They are run of the mill in all the far western states. I have poked my long nose into this cougar business for so many years and asked questions, that if fifty ranchers wrote me tomorrow, enclosing sworn affidavits detailing their lion troubles, I would still confidently state that they were exceptions, not the rule In fact, I have found that of all the misfortunes that can befall a calf growing to cowhood, cougars are at the bottom of the list.

None of this is intended to whitewash the cougar's personal character. I love him not, and would as soon have a puff adder or a Chicago racketeer for a pet. But he has a definite and important place in our wildlife community. He is a cog in Nature's machine, and no amount of vilification changes the situation one iota. Where these huge native cats have been reduced or eliminated we have such problems as Arizona's Kaibab Plateau swarming with 100,000 hungry deer; Murderers Creek in Oregon, where 4000 deer starved to death; and Yellowstone's headache — trying to accommodate 13,000 elk on a winter range with half that capacity. Due to the reduction of predators, similar conditions are developing throughout the far West and they are already defeating efforts to establish a wise and balanced management of our wildlife.

And after all, what red-blooded American with an ounce of pioneer blood left in him wants to substitute unnatural hordes of tame, liquid-eyed, semi-domestic deer and elk for our magnificent, varied, original wildlife? A well-known newspaper editor expressed this viewpoint recently. "I would rather see a lion or a wolf than a deer or mountain sheep," he said. "They are much more interesting animals. I am not concerned as to whether the wolves and lions are killing deer or sheep. Are there enough deer and sheep to feed the lions and wolves?"

It is the cougar's natural right to pull down a fawn, says Freeman Tilden in *The National Parks*. "No young tree can survive on an overgrazed deer range," writes William A. Du Puy in *The Nation's Forests*. "Carnivores are so very vital to the well being of the wildlife as a whole that we must protect them," states Paul E. Schulz, naturalist at Lassen National Park. "It is apparent that with the decreasing number of predators, and a premium on the mountain lion in particular, it will be necessary to continue deer and elk reduction programs," is veteran Sequoia Park ranger, Clarence Fry's opinion. "But," says Schulz, again, "Why do it the hard way? Predator protection turned out to be the means of restoring normal conditions on the Kaibab. Mere restoration did the trick. Further control wasn't necessary." And Victor H. Cahalane, after many years of field work in the Biology Division of the National Park Service, (Continued on page 50)

An ancient baobab, showing the great girth of the older trees and the root-like appearance of its branches. Also may be seen the scars left by the removal of the bark, from which the natives make strong cord and coarse fibers. The trees appear unaffected by this seemingly rough treatment.

Baobab — The Upside-down Tree

By COL. ROBERT BRUCE WHITE

It was the division forestry officer at Mombasa, a jolly Yorkshireman, speaking, and, because he had spent much of his life in East African forests, he spoke with authority. "According to the natives of Kenya," he said, "the devil once became so angry with his wife — or harem — that he started throwing things about." Jim Templer grinned, and the fluffy white sideburns on his broad face made me think of a character out of Dickens.

"In this ugly mood," he continued, "Satan pulled up those baobab trees you admired so much when your ship entered Mombasa harbor. He tossed them up so high that, when they came down, their branches sank deep into the earth, leaving only their trunks and roots exposed. And ever since the baobab has continued to flourish upside down, in hell as it were. My good fellow, *every* African believes it's the devil's own tree."

The forest giant we were discussing was the baobab — pronounced bay-o-bab —, *Adansonia digitata*, a tree of immense girth and a strange appearance emphasized by the stubbiness of branches as large as the trunks of many great trees. Because in dry climates, away from the coast, they are leafless much of the year, their branches do resemble roots. But the Devil's tantrum must have been reenacted all over the continent. In Senegal and Angola on the west coast, in French Equatorial Africa and the Anglo-Egyptian Sudan, I had seen those immense gray trunks and uplifted claws. But in the approach to Kilidini Harbor, Mombasa, where the tropics are revealed at their best, the gaunt old baobabs along the shore, amid magnificent mango and ficus, gorgeous flamboyant and graceful palms, impress the visitor most of all.

Their big white blossoms, resembling those of some magnolias but having a rather unpleasant odor, are followed by a hard-shelled, melon-shaped fruit called *ki-boo-yu*, borne on long pendant stalks. This curious fruit in its neat, green, felt jacket, resembles the first aerial bombs used in the 1914-1918 war. The resemblance is even greater at maturity, when they fall to the ground, and burst, releasing their pods to the wind. The wood of the tree is soft and spongy, so soft that

Another baobab, showing the scars at the base of the trunk. Bark partially stripped off will continue to grow.

an axe can be struck into it so deeply, by a single blow, that there is difficulty in drawing it out again. In Mombasa there is an eight-inch cannon ball, fired during the Portuguese assault on Fort Jesus during the 18th century, which was found imbedded seven feet deep in the trunk of an ancient tree that faces the harbor. But the most impressive feature of the tree is its vast girth. Many are more than sixty feet in circumference, and a few have been found that exceeded one hundred feet.

"How old are these big fellows?" I asked my forester friend, who was modestly displaying, for my benefit, a portfolio of beautiful sketches of African flowering trees he had drawn to illustrate a scientific book on the subject.

"That no one can say with certainty — undoubtedly many centuries. Those at Kilidini were probably very old when Vasco daGama landed here in 1489. One specimen, eighty-two feet in girth when I measured it ten years ago, has grown less than an inch larger in that time."

Concerning their age, Dr. David Livingstone, the famous missionary-explorer, wrote: "The *mowana* (Bechuani for baobab) is the same species as those Adanson and others believed, from specimens seen in West Africa, to have been alive before the Flood. Those savants came to the conclusion that, therefore, there was never any flood at all. I would back the true *mowana* to survive a dozen floods. I do not believe that any of the specimens now existing reach back to the Deluge. I counted the concentric rings in one of these trees in three different places, and found that upon the average there were 81.5 to the foot. Supposing each ring to be the growth of one year, a *mowana* 100 feet in circumference would be only 14 centuries old which is some centuries less ancient than the Christian era."

What is more interesting than the age of these grotesque trees is their amazing vitality. Because strong cord and coarse fabrics are made by the natives from the fibers of its bark, they frequently denude the tree of all bark within easy reach. Undaunted by stripping that would kill ordinary trees, the baobab soon grows another coat; and still another if that is cut away. This explains why so many old trees will be found badly scarred, and why they may be several inches greater in diameter above the stripping area than below. So wonderful is its vitality that a piece of bark partly stripped off, attached at only one point,

The baobab has large white blossoms that resemble those of some magnolias, but have a rather unpleasant odor. The trees bear hard-shelled, melon-shaped fruit.

will continue to grow as though nothing had occurred.

Even felling the tree will not always kill it. Again quoting Dr. Livingstone: "In Angola 84 concentric rings grew an inch in length after it was lying on the ground." Not even bush fires kill this sturdy tree, and its roots, which may extend 150 feet away from the trunk. seem equally indestructible.

With its tenacious grip on life, this tree is not only immune to almost all external injury, but it is remarkably able to survive internal damage. Throughout much of Africa the trees are often hollowed out, used for storage purposes, and still they flourish. Probably the most extraordinary use of the tree was reported many years ago in the Belgian Congo where, according to early explorers, certain tribes used hollow baobabs as drying chambers in which corpses, denied burial under more sacred ground, could be suspended until mummified. The famous 14th century traveler, Ibn Batuta, reported having seen a hollow baobab used as a dwelling by an Arab weaver, and that many were used for the storage of water or honey. Dr. Livingstone mentioned one so large that twenty or thirty men could lie down in it.

I asked Jim Templer about this practice. He seated himself in a siesta chair and put his hairy legs on its extended arms before resuming the discussion.

"For my money," he said, "the most interesting use made of baobabs is for the storage of water. This I have often seen up in Kordostan. In the Sudanese deserts you can travel hundreds of miles during the dry season without ever finding a stream or well. Without baobabs — called *tebeldis* there — Kordostan might well be depopulated. The Arabs scrape a small pond around the base of the tree. Then, after a shower, everyone turns out to fill up the hollow trunks, using goat-skin buckets to fill them from the top. Like your tree experts in America, they use cement or bricks to mend leaks in the tree, which may hold as much as 1200 gallons of water. I am told that the living tree keeps its contents as sweet and fresh as any well water. Each family has its own tree, if they have any social rating at all. And from it they sell water to passing caravans. Quite a novel idea in service stations, eh?"

"Does the tree have any other commercial value?" I asked.

"No little — by the natives," he answered, his eyes twinkling. "The ki-boo-yu seed and pulp are edible as gruel, and they also use the leaves as you would spinach. Over in Nigeria they feed the leaves to mules and horses. And because the pulp contains tartaric acid, it is widely used as a food seasoner. Here, try some. You'll find it has a cool pleasant taste."

He rose from his chair, and from a littered desk handed me a broken fruit to examine.

"But where the baobab really goes to town is in the hands of the *m'gangas*, the witch doctors," Templer continued. "That goes back of course to devilish origins of the tree. For centuries baobabs have played an important role in *m'ganga* ceremonies. Their cure of the sick and wounded is by the ancient system of casting out devils, who, when they leave the poor invalid, resume residence in the nearest baobab. That explains the sacrificial food and bits of cloth you find tied to branches of the trees upcountry.

"You won't find much recognition of the baobab in the British pharmacopaeia. But the *m'gangas* use various derivatives of the wood or the fruit to cure earache and dysentery, to prevent malaria and yellow fever, to help weak or ailing babies, in a steam bath, and even to correct genito-urinary disorders. On the other hand certain tribes in Madagascar have given the tree a name I can not recall, but it means 'good for nothing.' Take your choice, my friend."

So saying, my talented host clapped a battered topi on his head, and stepped from the cool of his office into the blazing sunlight of the street. "Come along now," he said. "We'll take a few pictures of my African beauties."

Landmark

By ELIZABETH PHILLIPS JONES

The patriarch
That watched the tread
Of fearless searching feet
Is almost dead.

Long since
Those eager, questing faces,
Too, have found
Their final resting places.

The path still is
The self-same clay,
Rendering service
To feet of later day.

The tree, bivouacked
In body and ancient limb;
Reminder of souls afire
'Neath its branches trim,

Is content to dream,
As an old man
Whose heaven-turned eyes
The far horizon scan.

Skylarks Abroad

By DOROTHY GORDON COX

The skylark is a dun-colored little bird, blending with its surroundings and nesting on the ground. Migratory in Europe, the immigrants to Canada seem to have lost their migratory instinct.

PHOTOGRAPH BY L. J. LANGFORD

WHO CAN tell how sadly people of the Old World miss the sights and sounds of their homeland while starting a new life in some far corner of a strange country? So it must have been with those intrepid souls who pulled up their roots from the downs and moors of Britain to plant them again in the forests of Vancouver Island, the fringe of a far continent!

Singing here to welcome them were birds of the deep woods, strangers to people of an old and settled land. The varied thrush may have greeted them those first lonely winters, although only those who live in the mountains are privileged to hear its glorious voice. The cheery winter wren, however, poured out its melody from the new brush piles and low thickets. The sociable Bewick's wren doubtless cheered early pioneers with its burbling and unpredictable bursts of song the year around. The song sparrow sang from high on the wild cherry and wild crab. Later, as the forests receded and farms took their place, the meadowlark must have arrived and surprised the newcomers with its size, beauty and golden voice.

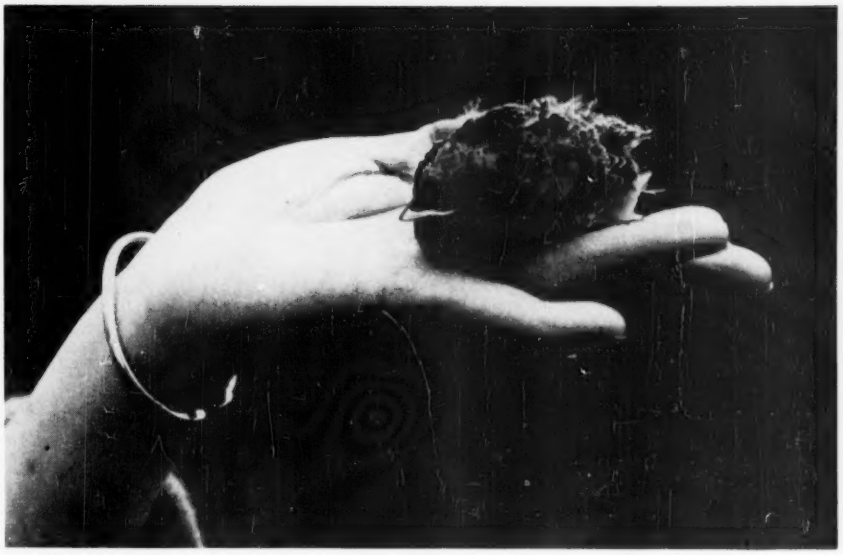
But these birds were all strangers, and perhaps only served to intensify their longing for the birds of the homeland. Especially did they miss the skylark, the English robin and the thrush.

As a city grew where a fort had stood, life became less strenuous, and, in due time, a natural history society came into being to study the natural wonders of a new land. But the descendants of those first settlers remembered the talk of the birds at home. And newcomers still heard the British bird songs ringing in their ears. So it is not surprising that this echo found expression. On August 19, 1897, when the natural history group was meeting, the members discussed the possibility of bringing British birds to British Columbia. Once planted, the seed found many hearts in which to grow, but it was not until 1903 that the idea bore fruit. That year an order was placed in England for a shipment of British birds. The government of British Columbia "generously" donated $200, and $300 was subscribed by nostalgic citizens.

Air transport, however, was scarcely a dream in 1903. The shipment made contained goldfinches, thrushes, linnets, robins and skylarks, but many perished on the long, slow journey. Only the larks survived. These were cared for in a greenhouse until apparently fit to be released. But it was the fall of the year, the birds had not become acclimated, and few, if any, lived through the winter. It was a tragic end to the undertaking; the saddest part the suffering imposed upon the little songsters.

The skylarks' nest is a poor affair, loosely constructed of old and weathered grasses with no soft finishing touches.

Ten years later, the old yearning refusing to be downed, another shipment was ordered, this time in the spring. However, "somebody blundered," for even when the birds left Liverpool they were "beginning to droop," the record states. Neither well packed nor well cared for, they arrived in pitiable condition. However, great care was given the survivors, and more than three hundred birds were released, including forty-nine skylarks. As the Provincial Government had assisted in the undertaking, the birds



A baby skylark on the hand of the author.

PHOTOGRAPH COURTESY OF VICTORIA DAILY TIMES

were divided. One group, including twenty-four skylarks were released on Lulu Island, delta land in the mouth of the Fraser River. Still others were taken to Duncan, forty-five miles north of Victoria.

Lulu Island is very damp and often flooded, in parts; the rainfall in Duncan greatly exceeds that to the south. The windy, open spaces around Victoria and the southern tip of Vancouver Island admirably suited the skylarks, but all others perished, wherever released. So visitors to Victoria may now see and hear the descendants of these little singing immigrants, *Alauda avensis*, the European skylark. Nowhere else on the North American continent can it be seen and heard!

Considering the cat population in and around Victoria, it is a marvel that any ground-nesting birds ever live to grow up! An appeal to pet owners was made some years ago to keep their cats indoors at night so as to give the birds a chance to feed their young during the early hours. But the worst menace is from cats gone wild and forced to hunt to survive.

In spite of enemies, the skylarks increased and, by 1930, had spread north and east of the city. On Landsdown Air Field, on Cedar Hill, Oak Bay and Uplands golf courses, one could see and hear the skylarks, as well as on Saanich and Gordon Head farms. For the past few years they have been seen in Sidney, twenty miles north of Victoria. There was a report from a former resident of Victoria that the birds had been seen and heard on the mainland high on a mountain plateau, where natural meadows would make an ideal nesting ground. If this proves to be true it will be of great interest. In Europe, the skylarks are migratory birds, but here, in their struggle to survive, perhaps, or because of the complete break with their pattern of life, this instinct, result of centuries of migration, has become inhibited and the skylarks seem content to move in a very limited sphere.

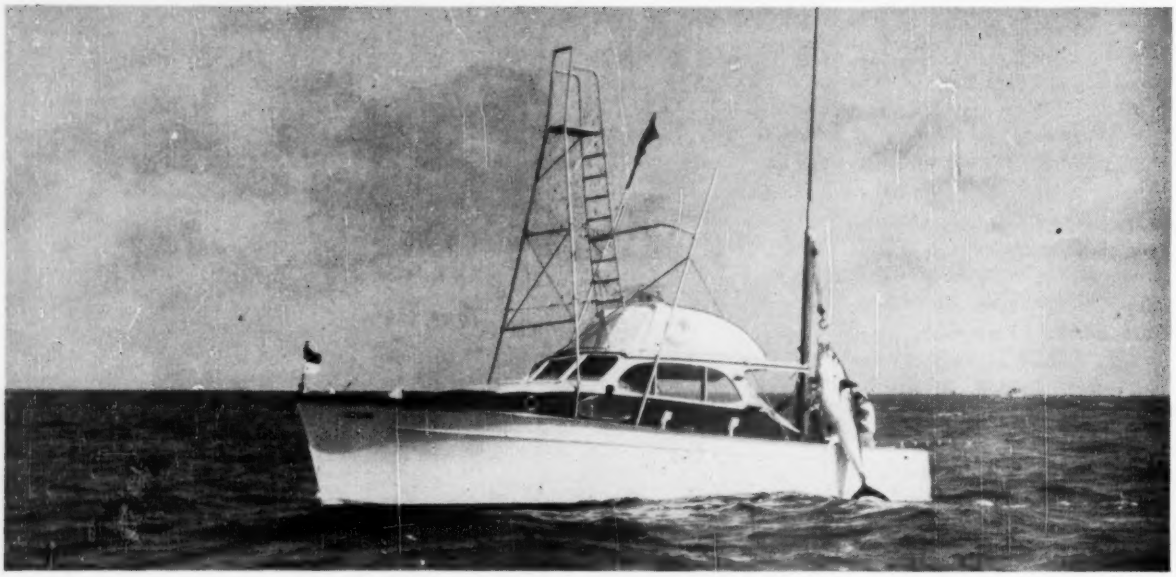
Now, after forty years, comes a new and surer means of forcing the skylark from the city environs. Where once was a polo field, a Chinese market garden, a race course, and acres of hay fields, where larks have lived continuously all these years, are houses, houses and more houses, new streets, a playing field and, always, automobiles. Luckily the farms are still farms; the golf courses have not yet yielded to development, but one must go far afield now to see and hear this bird of the wide open spaces that they frequent in England.

Few birds have been signalized in literature as have the little dun-colored skylarks. Bruce Hutchinson once said in his column that it was solely because they had such a good advertiser in Shelley! Said Bruce, "Never mind, the Skylark will continue to be regarded as the final perfection of music by people who never heard it, who listen to better songs by the roadside every day but prefer to accept Shelley's verdict instead of the opinion of their own ears!" Perhaps some Canadian poet will out-Shelley Shelley about a Canadian meadowlark, for instance, but poets of England are still inspired by the bird, ". . .which intoxicates itself with sunshine." Certainly they do achieve wonderfully sustained melody while hanging high in air and "melting in the flood of light," circling higher and higher until the bird is lost in the blue, and only the song comes to us from on high.

At certain seasons the skylarks fly low over the fields, as dun-colored as the earth and stubble under them, betrayed only by their soft, continuous singing. Now and then they perch on a haycock, head held high to scan the field, or sit on a fence post to sing, the quality of the voice making it hard to determine its source. But these are rare occasions, for their feet are not made for easy perching, having long toes and claws; the hind toe and claw especially long like a tiny ski to aid in running over the grass.

The skylark's nest is a poor affair, a deep hollow in the ground, lined with old and weathered grasses. Little attempt is made to add soft finishing touches. The nest is so loosely built that it was with difficulty I was able to collect one without its falling to bits. Adhering to it were the filaments of golden brown down that wave from the bird's head like tiny fairy wands, even after the feathers have grown!

These nests are the reward of much searching! For years I quartered the Landsdown Air Field without success. On April 23, 1938, Victoria natural history enthusiasts proudly escorted (Continued on page 50)



A giant bluefin tuna is boated off Cat Cay.

Tagging A Mystery Fish

By E. JOHN LONG

EVER since the days of the ancient Greeks the tuna has been a mystery fish. Aristotle speculated about the origin and habits of this giant mackerel, shoals of which appeared in the Mediterranean each year, and, after a regular interval, disappeared as suddenly as they came.

In the intervening centuries scientists have learned a few things about the biology, the number of species, and the range of the tuna. As for its breeding habits and other details of its life history — well, most of the findings in recent times might be summed up as those of a "great wanderer."

Ranging as it does over vast oceans, a blue water fish that is seldom seen except from planes, or by fisherman far from shore, the tuna presents a considerable challenge to mere man's efforts to pry into the secrets of its domestic life.

Anyone who has made any sort of study of our largest game and food fishes knows that the riddle will not be solved quickly nor easily. But, beginning in May, 1952, an impressive group of scientific institutions banded together to explore one phase of the tuna problem — the life history of the bluefin tuna, *Thunnus thynnus*, in western-Atlantic waters.

It all started at the Bermuda Oceanic Fish Conference. A general plan was developed whereby the Marine Laboratory of the University of Miami would initiate an aerial and marine investigation of the bluefin that would extend from warm Caribbean waters to the chilly banks of Newfoundland.

Cooperating in this far-flung, long-range study, one of the most ambitious marine investigations ever undertaken, are the U.S. Fish & Wildlife Service, the Woods Hole Oceanographic Institution, the U.S. Coast Guard, the Bahamas Government, and others. Most of the initial expenses will be met by a grant from the Charles F. Johnson Foundation.

The present cooperative project, in fact, is following a trail blazed by Dr. Howard Schuck, of U.S. Fisheries Station, Woods Hole, Mass., and Dr. Frank J. Mather, III, of the Woods Hole Oceanographic Institution. It is a well established fact that bluefin tuna pass Bimini and Cat Cay, the Bahamas, in great numbers each May and June, and there is intensive sport fishing for them.

Giant tunas arrive off New England and Nova Scotia in late June and July, and it is generally believed that these are the same fishes that pass the Bahamas. It was with the hope of establishing this as a fact, rather than a theory, that the Woods Hole scientists, with the cooperation of sport fishermen, introduced the tagging of tuna with marked hooks at Cat Cay and Bimini in May and June, 1951.

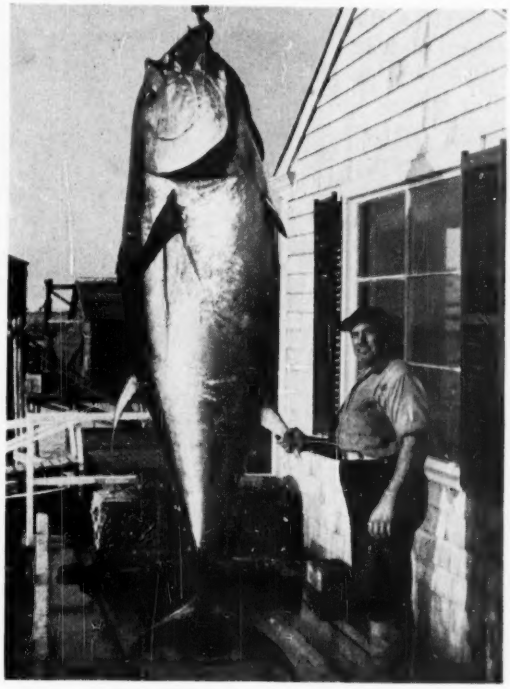
A two-dollar reward was offered by the U.S. Fish and Wildlife Service for the return of marked hooks. No returns were obtained in 1951, perhaps due to the poor season for giant tunas in New England that summer.

In 1952 Dr. F. G. Walton Smith, director of the Marine Laboratory, University of Miami, assigned a team of marine specialists from the Laboratory staff, headed by Dr. Luis Rene Rivas, to the southern phase

of the project. Again sportsmen and commercial fishermen were asked to help, and special instructions were issued to yacht clubs and to those taking part in annual tuna tournaments.

For, in addition to air and surface spotting and photography, Dr. Rivas and his associates wanted to tag as many migrating bluefin tuna as they could. This meant catching specimens by hook and line, or by net and releasing them, unharmed — both costly procedures. Size was not important, and this is where game and commercial fishermen could cooperate in the project if they would. Small specimens, which sportsmen and food seekers would throw back anyway, make as good (better, because they live longer) tag carriers as big ones, just so they are properly tagged before being released.

The idea of using a marked hook to shadow the elusive tuna is attributed to an Italian scientist, Massimo Sella, who traced the migrations of tunas in the Mediterranean and eastern Atlantic by the hooks found in tuna caught commercially. In this case, the hooks were unmarked but he was able to determine their origin by their construction and the method of attaching the line or leader. The hooks were then — in 1929 — of local manufacture and each region had its own typical patterns and way of attachment.



U. S. FISH AND WILDLIFE SERVICE PHOTOGRAPH

This fine specimen of bluefin tuna was caught by commercial fishermen off the New England coast.

As mass-produced hooks replaced the homemade variety, Sella and other European scientists developed methods of marking hooks to provide a more positive method of identification. Marked hooks were issued to the commercial tuna fleet at Groix, France, and in 1933 F. S. Russell released several tuna with marked hooks from the yacht *St. George* in the North Sea. Unfortunately no returns were obtained in either attempt, probably because an insufficient number of fishes were "tagged."

When the current project was conceived, it was thought that a "hook tag," consisting of a marked plastic-coated or rustproof hook was best suited for the purpose, owing to the strength and pugnacity of the giant fish. The method first proposed was to use a marked hook on a leader wire of low breaking point, releasing in this manner the fish immediately or shortly after hooking. But it was found that the big fishes were able to get rid of hooks, so the method was modified. A special type of hook with a snap spring between the shank and the barb, and behaving like a ring, is believed to stick with the fish. In addition to hook tagging, the same individuals are being tagged with a strap-type opercular device, similar to the tag used for marking cattle on the ear.

The latter requires bringing the fish alongside a boat by means of heavy rod and reel tackle, or by strong cable operated by a winch. Speed is important so that the fish will not be so tired out that it will become ready prey to sharks and other predators. The tag itself is a metal strip, bent into a "U" shape form with a pointed end that slips through an opening in the other end. Special pliers are used to fasten it securely to the gill cover. Made of aluminum, the tag bears the inscription "University of Miami," followed by a number.

The period of research during the Cat Cay Tuna Tournament in the spring of 1952 was most successful. Dr. Rivas reports that, while his group was not able to tag as many fishes as was expected, about fifteen bluefin tuna were tagged with hooks and eleven with opercular tags.

The Miami group was also able to study and measure carefully thirty-five specimens of bluefin tuna caught by sportsmen. These specimens ranged in weight from 297 to 565 pounds. Both males and females were found to be recently spent, indicating that spawning was taking place right along the Bahama bank off Cat Cay. This assumption was later confirmed at Bimini during early June, when many eggs were collected and hatched in the laboratory at Miami. Larvae were kept alive as long as five days.

A slightly different tagging procedure is being followed by the Woods Hole Oceanographic Institution. As a result of interest shown by sports fishermen in the project, the United States Tuna Tournament Committee has officially sponsored the use of marked hooks. So hooks are now marked for sporting goods distributors patronized by tuna fishermen. Woods Hole favors hooks marked with stainless steel bands bearing serial numbers. It previously had stamped letters and serial numbers on the hook itself, and also banded the shank with a red plastic sleeve. The latter is mentioned in case some granddaddy tuna is captured years hence with such a hook in its stomach.

All along the Atlantic seaboard, at clubs, docks, fishhouses, etc., the following notice has been posted:

"TUNA TAGS — $2 REWARD

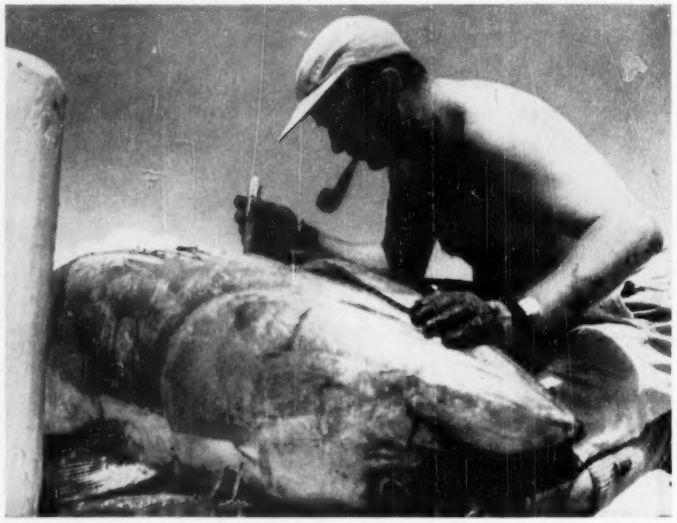
Bluefin tuna have been tagged with marked hooks to determine migration routes and to identify populations. The number is stamped on or near the bend of the hook, on the flat surface. If they are rusty, sandpapering the flat surface lightly may bring out the numbers.
Please examine the mouth, head, throat and stomach of all bluefin tuna caught. If you find a marked hook, send it, with the *Date* and *Place* the tuna was taken, and your name and address to: U.S. Fish and Wildlife Service, Washington, 25, D.C.

A reward of two dollars will be paid for the return of each marked hook. If you wish, the hook will be returned to you."

Once migratory routes are established, oceanographic investigations can be undertaken along the routes to learn the ecological factors affecting migration in general. Scientists thus far have been operating in the dark in their studies of this important relationship between the bluefin tuna and its environment.

There was considerable excitement in oceanographic circles last spring when specimens tentatively identified as baby bluefin tuna were discovered drifting in the Gulf Stream off Miami, the first time they have ever been found in the western Atlantic. Tiny specimens, so small that twenty or thirty of them could be placed in a thimble, were taken during a National Geographic Society-University of Miami study of plankton, the microscopic life that floats in the sea.

The specimens showed that spawning may take place not far from Miami itself, or possibly in the northern part of the Caribbean. From there the young fishes drift north in the currents that eventually join the Gulf Stream.



Dr. F. G. Walton Smith, director of the Marine Laboratory at the University of Miami, dissecting a bluefin tuna.

In addition to research with plankton nets and the tagging, the University of Miami has been using planes for aerial spotting over a wide area. During March, 1952, a flight to the middle Caribbean revealed a school of bluefin tuna in an area about midway between Jamaica and Cape Gracias a Dios, Honduras. This observation tends to confirm reports that the big fishes follow a regular migratory route from the open Atlantic through the various passes between the Lesser Antilles (Guadaloupe, Dominica, Martinique, St. Lucia, Barbadoes, etc.) and pass through the Yucatan Channel en route to the Straits of Florida and northward with the Gulf Stream.

Although the bluefin tuna is not the world's largest fish, it is runner-up to the whale shark and the great white shark. The heaviest specimens of bluefin tuna yet recorded weigh from 900 to 1000 pounds. It is expected that larger individuals will eventually be taken now that a real study of the fish is being conducted.

In its native deepwater haunts the bluefin is a magnificent, swashbuckling fish. Its speed is amazing. Big specimens have been clocked from boats, and they have been observed doing eight knots for long distances without any effort. It hits much higher speeds when it dashes into schools of herring and mackerel, its favorite foods, whose migrations the tunas are believed to follow.

Every line of the bluefin's powerful body suggests rapid motion, which accounts for its popular nickname among game fishermen: "The blue torpedo of the Atlantic."

Like other members of the mackerel family, the bluefin tuna is able to maintain body temperatures of three degrees or more above that of surrounding water, owing to its tremendous muscular energy and a well-developed circulatory system. Extremely voracious, except during the breeding season, it will strike at almost anything a fisherman offers, down to a small two-ounce feather lure. And for rod and reelers it is sheer dynamite!

While thousands of bluefin tuna are seen each year in May and June along the eastern side of the Straits of Florida near Bimini, Cat Cay and Walker Cay, the big fish does not tarry long in the Bahamas. Moving northward at a speed estimated to be fifteen or more nautical miles a day, it has been seen in the Gulf Stream for some distance beyond the Bahamas. Then it disappears in deep water and does not reappear until it is well beyond the Chesapeake. Occasional specimens have been taken far off the New Jersey coast, but the bluefin is not found again in force until August through October, as it moves north in pursuit of smaller fishes well off the New England and Nova Scotia coasts.

At least, scientists *believe* these are the same tuna schools, although they will not have positive proof until tagged specimens are taken — if not this year, perhaps the next, or next! It is proposed to continue the tagging, if funds permit.

Because the bluefin tuna operates in deepwater areas, although near the surface as a rule, it is unfamiliar to most game and commercial fishermen. In fact, there are few good specimens in museums. Consequently

the untrained observer may readily confuse it with a mako shark or a porpoise. Mako sharks, however, are lone wolves; the tuna is gregarious, usually ranging in schools of five or more. The pectoral or side fins of the mako also are much longer than those of the tuna.

As for the porpoise, there is a sure clue. The porpoise has a horizontal tail fin; the tuna vertical.

In the younger stages there is even more possibility of confusing the bluefin with two other members of the giant mackerel family: the blackfin tuna, *Thunnus atlanticus*, and the Allison tuna, *Thunnus argentivitatus*.

Scientists at Miami offer two simple guides: (1) the bluefin tuna has a small eye, and (2) the dorsal or side fins of the bluefin are much shorter. Otherwise the young of all three are much alike, and the advice of those in charge of the project is: "When in doubt, tag it anyway."

Sponsors of the bluefin tuna research realize it is a long-range project, and that many of the fish tagged may not be caught for years, if ever. But it is a start, and yachtsmen, fishermen and others interested in landing a fish that has been tagged, or in tagging catches and releasing them, are invited to write to the sponsoring scientific organizations for further information and numbered tags or hooks.

Any of these volunteer co-workers may provide a clue to the solution of one of the most fascinating mysteries of the sea that still eludes our fish scientists.

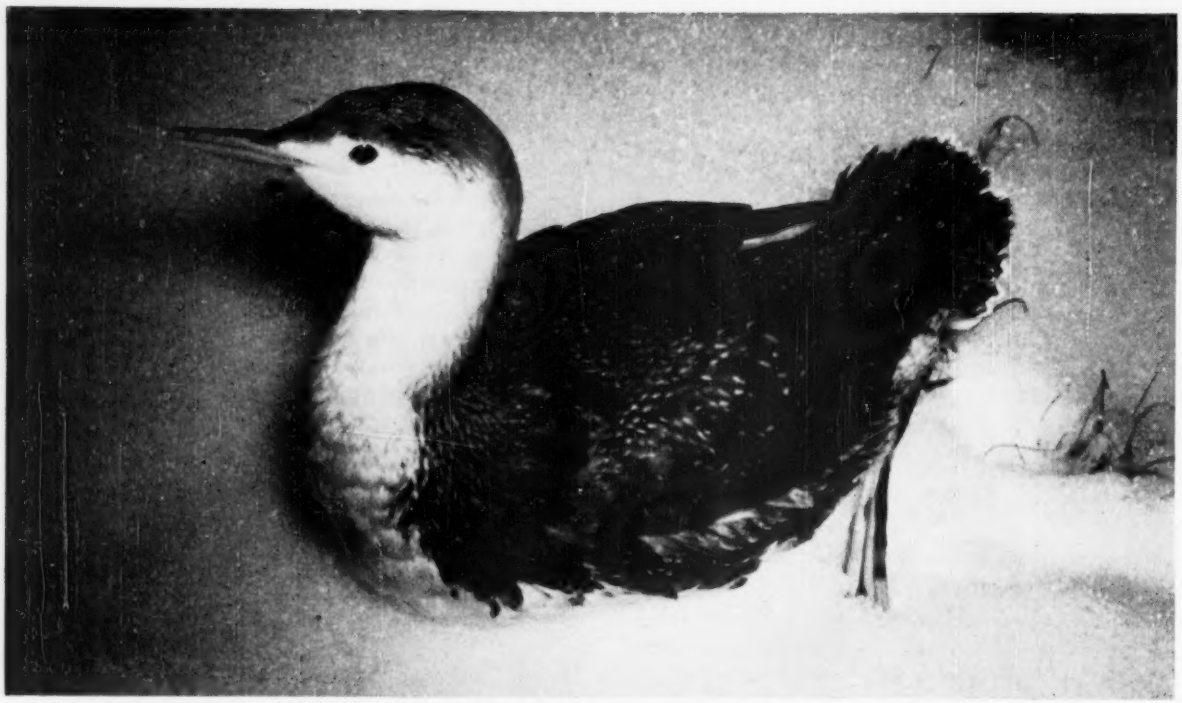
The Rubber Boa

By FERRIS WEDDLE

WHETHER it is called the silver snake, worm snake, or two-headed snake, the rubber boa, *Charina bottae*, is definitely a charmer among snakes. The nickname, two-headed, comes from the fact that at first sight, it is difficult to distinguish the head end from its tail. A companion and I were in the trail of a ruffed grouse with our cameras when I almost stepped on a knot of glistening gray snake. It did not move when I nudged it with my toe and I learned later that sulking, or playing dead, is one of the rubber boa's defensive characteristics. Something like twenty inches in length, the snake interested me because I could not at first see which end was the head. It wriggled a bit in my hand and felt surprisingly warm. Close examination revealed the two extremely small eyes and a slit of a mouth. The snake's belly was cream-yellow. After a few minutes my captive apparently decided it was safe to come to life and curled around my hand. After photographs were taken, we allowed it to slither its slow way into some brush.

The rubber boa is a member of the *Boidae* family, and is the only relative of the boas widely found in the United States. The rubber boa grows to an average length of about eighteen inches, although my specimen was twenty inches. It ranges from Washington through California, and east into Montana, Idaho, Wyoming, and south into Utah and Nevada. Two related forms are found in the extreme Southwest. Rubber boas still have vestiges of a pelvis and hind limbs.

Mild in temperament, rubber boas make excellent pets, subsisting largely on mammals, killing them by constriction. They appear rubberlike in color and texture, with the colors varying from brown through gray and olive. They reveal rubbery characteristics, too, when they contort and twist their bodies, hiding their heads. This is, no doubt, along with a secretive nature, a method of defense and protection. This snake favors a damp environment, and is primarily a burrowing species. Its breeding habits are not known.



The red-throated loon stranded on snow, and, below, restored to water. Although a capable long-distance flier, the loon is almost helpless on land. This bird catches its meals of fishes by diving and outswimming its prey under water. As with all loons its webbed feet are set far back for swimming and diving.

PHOTOGRAPHS BY THE AUTHOR

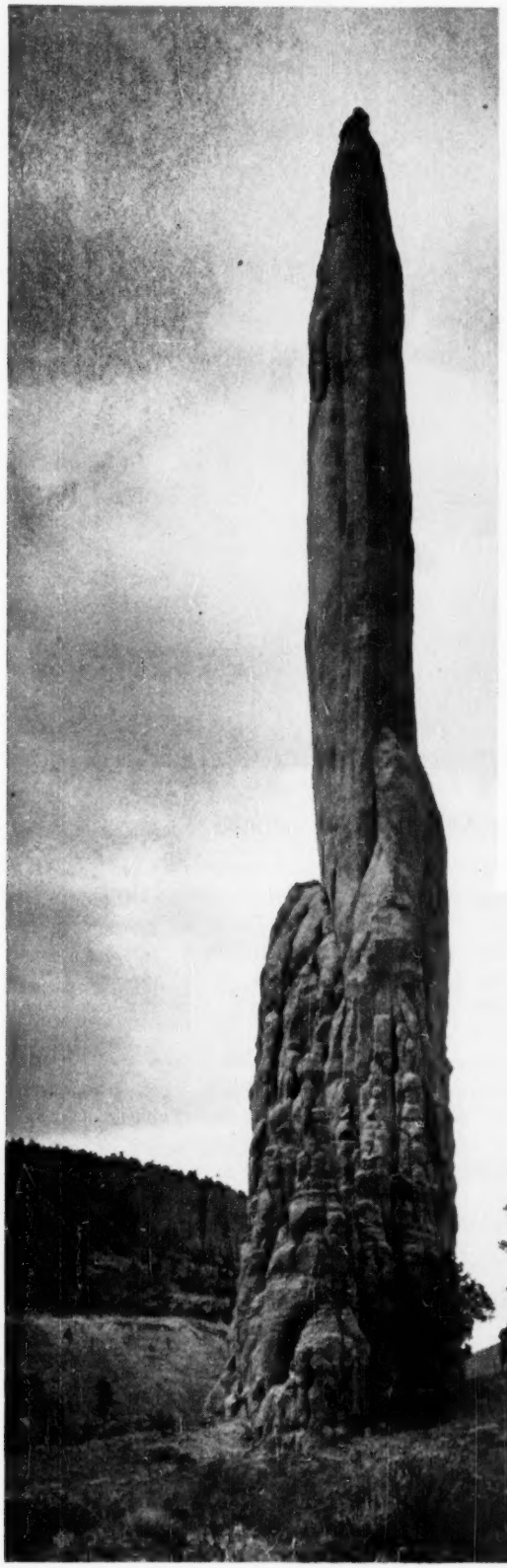
Red-Throated Loon Crashlands

By GEORGE AARON SMITH

A BIG red-throated loon, flying south from the north Atlantic coast, was forced to crash land during one of last winter's severe ice storms. When the loon was found in the snow its wings and back were covered with ice. Once on the ground the loon was practically helpless because, like a hydroplane, it must have plenty of water for a take-off. A loon's feet are not developed for graceful walking, and it can only crawl along with the aid of its bill and wings. When stranded on land a loon usually is easy prey.

Fortunately this loon was rescued by two school boys, David and Jacob Nissley, of Quarryville, Pennsylvania, who brought the bird to me. After the big, salt-water bird, about the size of a full-grown duck, was identified, one distinguishing character being its long, sharp and slightly upturned bill, it was kept for several days in the bathtub at my home. There it enjoyed private swimming and a daily diet of vitamia-enriched, canned dogfood. Finally the family, rather understandably, objected, and the loon was taken to a large campus lake at the nearby Millersville State Teachers College. After a few days of college education, and several good meals of goldfish from the well-stocked lake, the red-throated loon took off without waiting for spring commencement.

Cleopatra's Needle in New Mexico's Valley of the Obelisks.



Lost Valley of the Obelisks

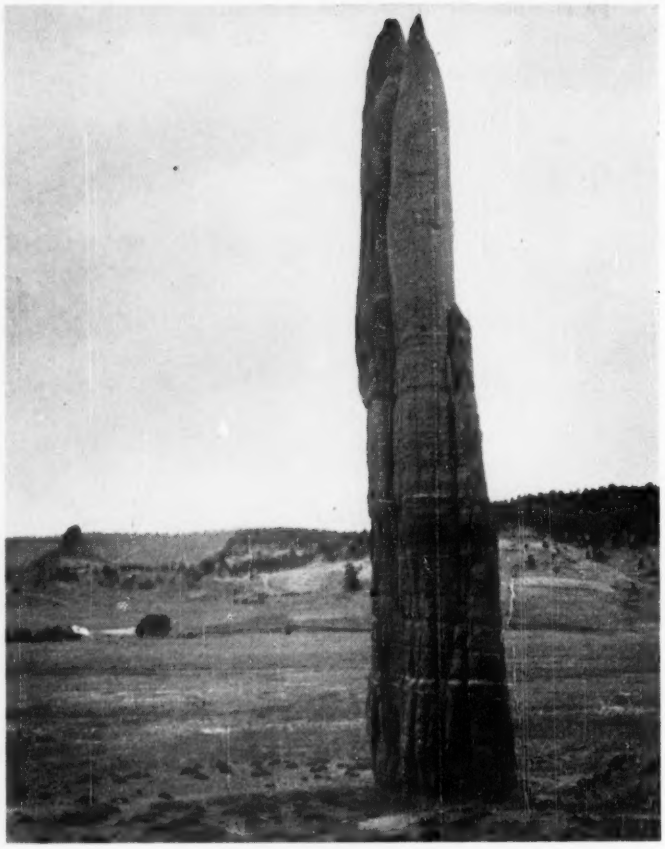
By NELL MURBARGER

Photographs by the Author

IF FIRST-TIME visitors to New Mexico's Valley of the Obelisks feel something like the bewildered skeptic who decided to believe nothing that he heard and only half of what he saw, it is quite understandable. Sights such as Cleopatra's and Venus' Needle are not encountered every day in the year! Even that master of impossible projects, Old Man Erosion, must have found it quite a job to turn a desert mountain into a broad flat, and leave protruding from its floor a pair of sandstone toothpicks, each as high as a twenty-story building and no larger at its base than a good-sized living room!

Newest, and one of the most spectacular scenic discoveries in a region world-famed for its color and beauty, this fantastic, hidden valley, on the Navajo Indian Reservation, was first visited by white men about forty years ago. Due, however, to certain difficulties of access, which have secluded the area until recently, even the landscape of the moon is scarcely less known to the traveling public.

Outstanding among landmarks of the valley are its incredible "needles." Cleopatra's thrusts its slim finger skyward to a dizzy height of 213 feet; and Venus', equally sheer and equally "impossible," is only six feet lower. Other prominent features, chiseled into form during millions of years of erosion and volcanic fury, bear such expressive names as Beelzebub, the Beast, the Teapot, Green Knobs, and others. Also many



Venus' Needle, Valley of the Obelisks. Sprouting from the level plain, this toothpick-like tower rises to a height of 207 feet.

natural arches are in process of forming in the high escarpment of red sandstone that circles the valley.

But for the dried-mud and pole hogans of two or three Navajo Indian families, the area is completely uninhabited, the nearest settlement being the small trading post of Fort Defiance, in Arizona. Situated approximately fifty miles northwest of Gallup, New Mexico, on U.S. 66, the obelisks are best reached via U.S. 666 and State Highway 68 — both paved — to Window Rock. From this point, thirty miles of graded earth road and good desert trail, all suited to passenger car travel, lead northward through Fort Defiance, up scenic Black Creek, past Red Lake, and over pine-forested hills to the hidden valley, where Old Man Erosion may have won his master's degree in the art of sculpture. Being relatively inaccessible and off the beaten path, this display is not often visited, but a side trip to see it is well worth the effort of the traveler interested in the works of Nature. Resident Indians take them as a matter of course.

Biblical Zoo

By MABEL IRENE HUGGINS

IN THE following quotations from Biblical literature names of specimens of animal life have been omitted. Can you supply the right ones? Score 5 for each correct one. 75 is fair; 90 or above, excellent. Answers on page 50.

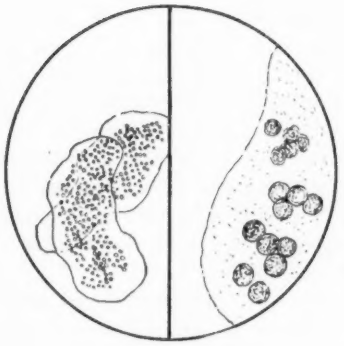
1. Let a ———— robbed of her whelps meet a man, rather than a fool in his folly. Prov. 17. 12.
2. A living dog is better than a dead ————. Eccl. 9. 4.
3. Beware of false prophets, which come to you in sheep's clothing, but inwardly they are ravening ————. Matt. 7. 15.
4. The ———— have holes, and the birds of the air have nests. Matt. 8. 20.
5. And she came to Jerusalem with a very great train, with ———— that bare spices, and very much gold, and precious stones. 1 Kings 10. 2.
6. Asahel was as light of foot as a wild ————. 2 Sam. 2. 18.
7. Once in three years came the navy of Tharshish, bringing gold, and silver, ivory, and ————, and peacocks. 1 Kings 10. 22.
8. The high hills are a refuge for the wild ————. Ps. 104. 18.
9. The ———— are but a feeble folk, yet make they their houses in the rocks. Prov. 30. 26.
10. The ———— shall lie down with the kid. Is. 11. 6.
11. And the sucking child shall play on the hole of the ————. Is. 11. 8.
12. And when Paul had gathered a bundle of sticks, and laid them on the fire, there came a ———— out of the heat, and fastened on his hand. The Acts 28. 3.
13. Barley also and straw for the horses and ———— brought they unto the place where the officers were, every man according to his charge. 1 Kings 4. 28.
14. As for the ————, the fir trees are her house. Ps. 104. 17.
15. There shall the great ———— make her nest, and lay, and hatch, and gather under her shadow. Is. 34. 15.
16. There shall the ———— also be gathered, every one with her mate. Is. 34. 15.
17. I am like a ———— of the wilderness. Ps. 102. 6.
18. Gavest thou the goodly wings unto the ———— ? Job 39. 13.
19. At the last it biteth like a serpent, and stingeth like an ————. Prov. 23. 32.
20. And the ———— brought him bread and flesh in the morning, and bread and flesh in the evening; and he drank of the brook. 1 Kings 17. 6.

Fresh-Water Algae

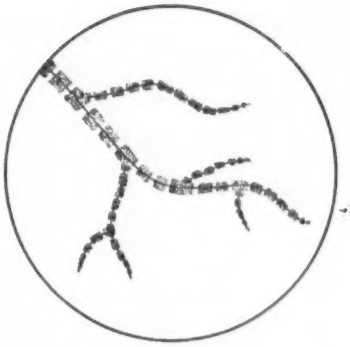
By E. LAURENCE PALMER

This is the sixty-ninth in NATURE MAGAZINE'S *series of educational inserts.*

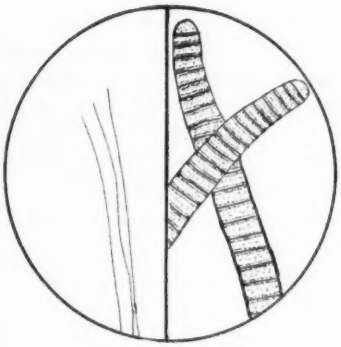
NOTE: In the illustrations, the algae in the left-hand semi-circles are of low magnification, the right-hand of high magnification.



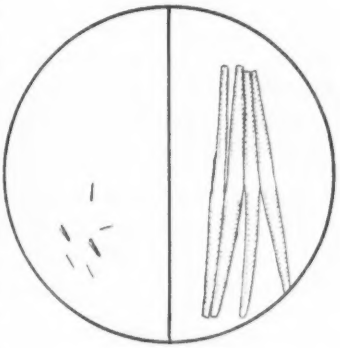
MICROCYSTIS



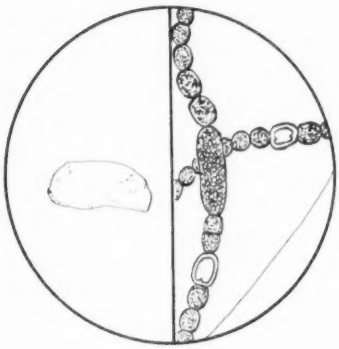
BATRACHOSPERMUM



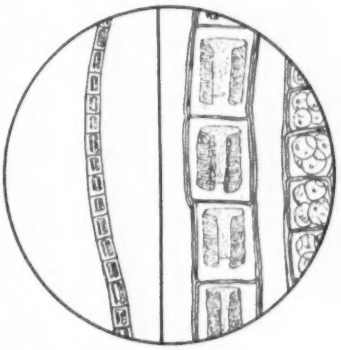
OSCILLATORIA



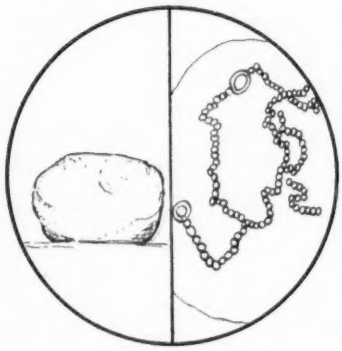
FRAGILARIA



ANABAENA



ULOTHRIX



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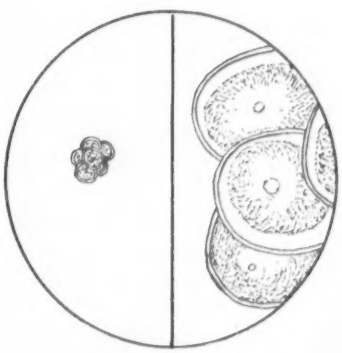


PROTOCOCCUS

AN EARLIER insert of this series dealt with sea-weeds, algae of salt-water. So it now seems appropriate to have a fresh-water counterpart to that marine unit, even though fresh-water algae cannot match in size their salt-water cousins. So close is the relationship between fresh-water and salt-water algae in the average mind, however, that I have heard Iowans from the middle of the continent refer to the algae in their streams as "sea-weeds."

Where and When Algae May Be Found: Algae may be found on the surface of rocks in running water. One might almost say that wherever water may be found algae may be found, but this is not so. They may even be found where there is no water. Sulphur springs, salt springs, hot springs, hard-water springs, bogs, lakes, streams, soil, plants, animals, rocks, clothing — all may harbor fresh-water algae at times. Of course, springs may be too hot; lakes too deep; rocks too dry to permit algae to flourish, but living algae have been found many feet underground, more than 150 feet under water, and in such apparently dessicated plants as some of the lichens. They may be found on glaciers, under ice, on snow banks in widely separated parts of the world. They may give color to the landscape, making it green, yellow, brown or even red. In short, it would be difficult to find outdoors, at any time, a time or place where algae are not to be found. Their presence may not be readily apparent, but, given time, it could easily be demonstrated.

Give one alga or another a little time, a little water, some light and a suitable temperature, and it can thrive almost anywhere. Their simple physiologic needs no doubt account in part for their ubiquitous, cosmopolitan nature. Without their presence there would be few living things in our waterways, and yet the presence of some of them in waterways is definitely contrary to the needs of some living things. You may think that

you have never seen these plants, but I doubt if any person who is not blind has failed to see fresh-water algae at some time or other.

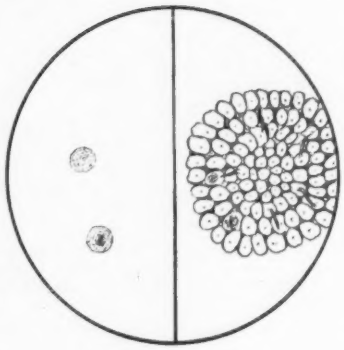
The Role of Fresh-water Algae in the Biological Society: Fresh-water algae are the basic food organisms in many waterways. As free-floating, or partly or wholly submerged plants, they may make up a major and certainly an important part of plankton. The animal part of plankton could not survive without the fresh-water algae on which they feed, and most fish feed on plankton organisms at some time in their lives.

Joined with certain fungi, some algae form a unique society that we call lichens. The algae use light and water to make food that sustains the alga and its captor fungus. The fungous plant supplies support for the alga, and provides water to some extent.

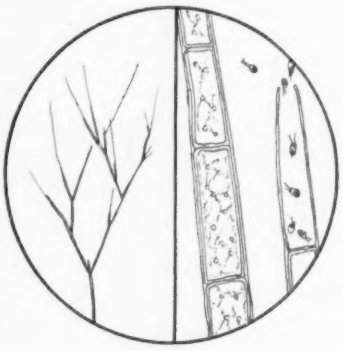
Some of the larger fresh-water algae provide a direct food supply for fishes and even for such large mammals as deer, moose and other plant-eating mammals. Most of the larger algae provide superior shelter and food for the smaller animals that provide food for such common game fishes as trout and bass.

The production of algae may be so stupendous at times that their numbers blot out sunlight normally available to organisms living deeper in the water. This may be dangerous, or it may be beneficial, depending on what is desired. It has been estimated that, in one year, as much as 200,000 tons of plankton pass the city of Havana on the Illinois River, and of this a goodly proportion are undoubtedly algae, with the remaining portion living off the algae.

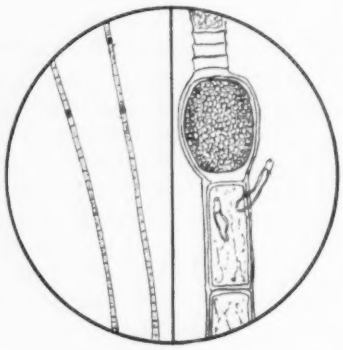
Algae and Physiography: It might seem strange to think of algae as moulders of the surface of the earth, yet they do play such a role. Stand by almost any stream, or feel the bottom of the stream, and you will see or feel masses of ooze or jelly. This jelly is probably muddy because it has taken silt from the water and held it in position. A continuation of this process would obviously build up the sediments on the bottom of the waterway more rapidly than would otherwise be the case. The absence of such oozes may well permit more rapid erosion of the looser soil particles beneath. So it would seem that these plants may build and hold, or permit the washing away, of soil particles. It is by these processes that the face of our earth is carved to a considerable extent.



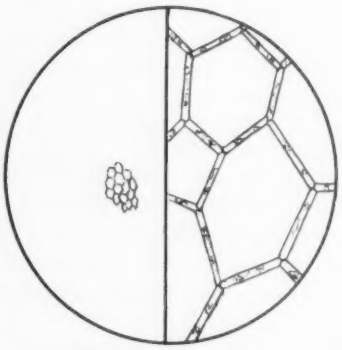
COLEOCHAETE



CLADOPHORA



OEDOGONIUM



HYDRODICTYON

Of course, the support these organisms give to plants and animals also makes them in part responsible for the changes these creatures contribute to the landscape.

Algae, through various physiological processes, make unique contributions to the earth on which they live. Some, like some of the nostocs, are capable of fixing atmospheric nitrogen. The significance of this must be far-reaching. Some, like *Chara* and many simpler algae, have the ability to take lime out of water, thus softening the water but contributing to the marl on the bottom. Some are associated with sulphur deposits and some with salt.

Possibly one of the most spectacular and important, and yet least recognized, relationships with the inorganic field is the role algae like the diatoms have in building up deposits of silica. On our west coast there are deposits of diatomaceous earths more than 700 feet deep, and these serve important economic roles, as you may see in the chart material under that title.

It is fortunate for us that the bottoms of many waterways are covered with the oozes caused by algae. Even the fine particles of silica left by diatoms may, with or without the oozes, serve as a screen that helps filter the water that goes into the earth beneath. Without such filtering much of the water that comes to the surface in springs might be unfit for human consumption. The materials filtered out of the water, of course, remain to build up land and change the face of the earth, at least to a slight degree.

Man recognizes this role of diatomaceous deposits in filtering, and the commercial filters maintained by municipal water plants use diatomaceous earths in part for this process. Some kinds of filter paper used in chemical laboratories are made in part of filaments of algae reinforced for strength with other materials. Other examples of the economic importance of these diatoms may be found in the chart sec-

tion of this special insert.

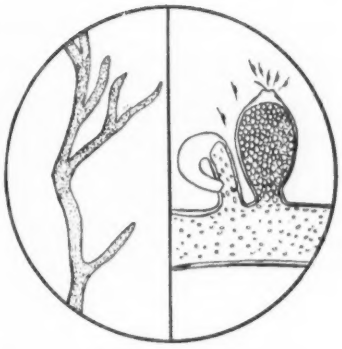
All students of natural history have been taught of the role of lichens in wearing away rock and in making from such rocks the initial soils from which our garden soils eventually develop. In thinking of this we must recognize that lichens are in part algae, and so algae do serve an important role in etching the hardest rock and thus gradually changing the topography of the earth.

The Economic Importance of Fresh-water Algae: It is not likely that men will cultivate fresh-water algae for commercial purposes to the extent they will marine algae, and yet there are those who will argue this point. Marine algae yield great quantities of potash and other valuable minerals, which we are not likely to recover from fresh-water algae.

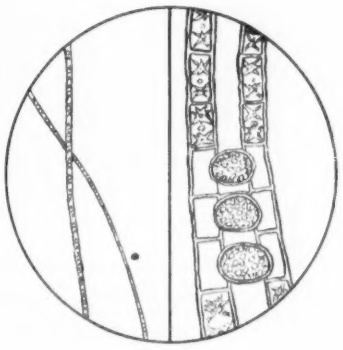
We have suggested the positive role of algae of fresh waters as the basic food for fish. There is a negative role that is important. Much of the difficulty of producing pure water for human consumption involves the control of algae. These algae, which may be found abundantly in drinking water, may affect the taste, odor and even the safety of the water for human use. The tabular matter gives you some understanding, for example, of how important the alga *Microcystis* may be in this connection. We could have added many others, particularly if we considered the realm of those organisms that are claimed by both the botanists and the zoologists. Some biologists list *Synura* as a plant in the algal group. It makes water smell like ripe cucumbers, and gives it a spicy taste due to aromatic oils that are freed. These oils are so strong that one can detect a dilution of one part in 25 million parts of water.

The fouling of swimming pools is a problem in some communities. This may be due to the presence of *Synura*, *Dinobryon* or *Uroglena*, all of which may be claimed both by the zoologist and the botanist. Fortunately some algae serve an equally important function in purifying the waters defiled by their relatives.

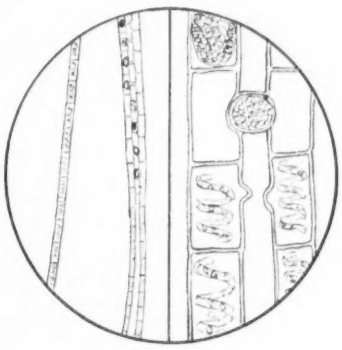
In these days of wars, famine and distress for great sections of the world's population, we are concerned about food. Food has been a problem ever since life appeared on the earth, and it will probably remain so to the end. Even today demagogues and others blithely ignore this situation, and continue to dissipate the food reserves they may have. Such policies cannot go on forever.



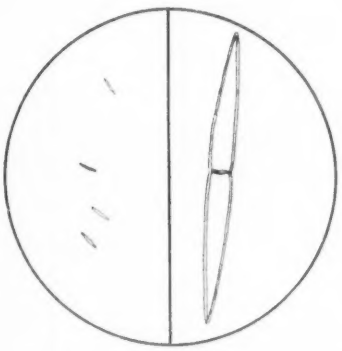
VAUCHERIA



ZYGNEMA



SPIROGYRA



CLOSTERIUM

We know that it is inefficient to eat meat from animals that must convert plants inefficiently into food for us. We may, because of this, eventually come to a vegetarian economy, or we must have wars and diseases to wipe out proportionately large units of our population; or the demand to limit populations, voluntarily or arbitrarily, gains favor. The next step after we had established an economy based on plants might well find us at a point where we depended more than ever on such simple plants as the fresh-water algae and yeasts that get their nourishment from the algae. You and I will not be here to see such a state of affairs, but it is just as logical to assume this will be the closing chapter of man's life on the earth as it is to accept some of the chapters that have been written about our earlier experiences on this terrestrial globe. There have been blatant, calamity-howling magazine articles written outlining the possibilities of such a future based on a lower-plant economy. There is enough logic in the arguments advanced for us to feel that unless history changes its trends this will be the story. When that time comes someone will study, manage and know our fresh water algae as well as we now know pigs, sheep, cattle, wheat and green apples.

The Management of Fresh-water Algae: Since fresh-water algae are of importance to man it is only natural that he has found ways to encourage and to discourage them, as his needs indicate. To a considerable extent this is by chemical means, but it may be otherwise.

I shall always remember the deep blueness of the pools in front of a Mormon temple in Hawaii. At first I thought the color was something that added to the picture, which was most appealing. I soon recognized, however, that it was due to copper sulphate that had been added to the pool to prevent the development of mosquito larvae. Copper sulphate is one of the chemicals most commonly used in controlling algae in lakes and *(Continued on page 32)*

NAME SCIENTIFIC NAME	MICROCYSTIS	OSCILLATORIA	ANABAENA	NOSTOC
DESCRIPTION	Free-floating masses of jelly, of irregular size and shape, enclosing colored cells that are not arranged in strings as in *Nostoc* and *Anabaena*. The cells are usually more crowded in the jelly envelope than is the case in *Nostoc* and *Anabaena*. Some of the cells may show false vacuoles.	Masses of fine, blue-green, hair-like colonies without the jelly covering described for *Nostoc* and *Anabaena*. Filaments are long and slender and unbranched. The cell units are frequently much wider than long like disks, but the colony may taper towards its free end. Color appears granular.	May appear in delicate mucous films or blobs, free floating or attached, usually clear and sometimes almost invisible. The colonies of cells show enlarged cells and clear cells in the necklace chain as described under *Nostoc*. Some *Anabaena* species are in plankton form.	Colonies may appear as firm, gelatinous balls to 2 feet long and 1 foot in diameter (*N. amplissimum*), but most species are in smaller colonies down to microscopic size. In gelatin are strings of almost spherical cells with occasional enlarged colorless cells. Colonies may be in solid, hollow, spherical, lobed, flattened or irregular masses of often muddy gelatin.
RANGE AND RELATIONSHIP	Class Myxophyceae. Order Chroococcales. Family Chroococcaceae. It has been said that classification here is based not on what characters are possessed by the plants but on the absence of those characters found in other closely related plants. There are more than 20 genera recognized in the family.	Class Myxophyceae. Order Hormogonales. Family Oscillatoriaceae. American genera in the family 11, and American species in the genus 30, or more. The strings or colonies of cells are called "trichomes," and in *Oscillatoria* lack the apparently empty cells "heterocysts" found in *Nostoc*.	Class Myxophyceae. Order Hormogonales. Family Nostocaceae. There are 7 genera in the U.S., and about 21 species in the U.S. The jelly envelope, if present in *Anabaena*, lacks definite form characteristic of *Nostoc*, and other differences are suggested under *Nostoc*.	Class Myxophyceae. Order Hormogonales. Family Nostocaceae. There are 6 American genera and over 20 species in the genus. *Nostoc* differs from *Anabaena* by having a firm gelatin with distorted strings of cells, while *Anabaena* has soft gelatin with rows of cells not commonly contorted.
REPRODUCTION	Reproduction is essentially by vegetative development and fracture of the colonies. There are 9 species of the genus to be found in the U. S., based in part on the shape of the cells. Apparently the reproductive process is reduced to its simplest elements.	Reproduction is largely vegetative, by the fracture of colonies. There are no "akinetes" or large resting cells such as are found in *Nostoc* and *Anabaena*. The cells acting as resting and reproductive cells are known as "hormogones," or a hormogone may be considered as a series of cells.	Reproduction is by fracture of colonies and essentially the same as is described for *Nostoc*, though the reproductive resting akinetes are conspicuously larger in some *Anabaenas* than in *Nostoc*, in proportion to other cells of the colony.	Reproduction is simply by cell division and breaking up of colonies, or by unusually long cells (akinetes), which develop only when the colony has reached maturity. The akinetes may be a resting stage and are adjacent to one of the clear cells heterocyst in the necklace chain of cells (trichomes).
ECOLOGY	*Microcystis* is essentially a plankton genus. It may cause "water blooms" to develop in hard water lakes and ponds. It may produce poisonous substances in sufficient quantities to be dangerous, but this is not necessarily so, and its presence in water is not always a menace.	The bottoms of streams, springs and shallow ponds may be covered with mats of this blue-green alga. *Oscillatoria* can survive in stagnant, putrid water, and its presence may be an index of heavy pollution. One species, *O. prolifica*, gives a red color to lakes in which it exists in plankton form.	There are 2 parasitic species, one living in leaves of *Azolla*. About half of the species are in plankton form including *A. spiroides*, *A. circinalis* and *A. flos-aquae*. Pond and ditch attached species include *A. catenula*, *A. inaequalis*, *A. oscillarioides* and *A. variabilis*.	Colonies may develop on small amount of soil covered with abundance of water, as an occupant of root tubercle on cycad, as a part of a lichen, at depth of over 60 feet in lakes and over 3 feet in earth. Some favor deep still water; others, rapidly flowing water. *Some may use atmospheric nitrogen.*
ECONOMY	In heavy concentrations *Microcystis* has been known to be fatal to live stock that drank water containing it. It has killed cattle and sheep and, under laboratory conditions and intense concentration, has killed guinea pigs and rabbits in from 12 to 15 minutes. It is obviously a dangerous water pollutant needing control.	May serve as a water purifier and certainly as evidence of pollution in some cases. Some species are found in damp soil, on exposed rocks, in mud. Species differences not well defined but may depend on shape of cells, straightness of strings, nature of ends of colonies, and so on.	In Lake Erie in July and August enormous quantities of *Anabaena* are produced in the shallow shore waters, making the water murky and generally unsightly but harmless. It may be a pollutant of drinking water supplies and as such an annoyance if not a serious danger.	Of considerable importance as a water pollutant. Gelatin takes silt out of muddy water and helps build soil. Has symbiotic relation with the horned liverwort *Anthoceros*. In South America the gelatin is boiled with garden vegetables to add flavor to the mixture. *N. commune* a common terrestrial species.

BATRACHOSPERMUM	A DIATOM *Fragilaria*	ULOTHRIX	PLEUROCOCCUS OR PROTOCOCCUS	COLEOCHAETE
Like long-branching, flexible strings with finer branching bunched branches in whorls, giving the impression of a string of tufted branches that grows smaller towards the tip. The axis is a single row of large cells. Whole plant is blue-green, olive, or sometimes violet, and gelatinous. Some may be distinctly reddish.	Diatoms are so variable and numerous that we can here consider them collectively. They may form much of the slippery oozes that cover stones in waterways, but are essentially boxes of silica enclosing chromatophores or color bearers that can multiply with startling rapidity.	Usually found as bright green, slimy, unbranched strings, though under some conditions branches may form. Cells are flat ended cylinders with broad gelatinous sheaths with one nucleus and a girdle shaped color band that nearly or completely surrounds the interior. Cells often shorter than wide.	Appears usually as a green coloring for the bark of trees, moist earth and stones, or even in the bodies of lichens. Under microscope appears either as small green spheres if isolated, or as a mass of compacted green spheres often imbedded in particles of soil, fungus strands or bark tissue.	Appears like small roundish green plate of cells, with a few long "hairs," usually found on the underwater parts of cattails and arrowleaf that remain underwater through the year. Some species do not appear in the characteristic shield-shaped plate of cells but as branched structures.
Class Rhodophyceae. Order Nemalionales. Family Batrachospermaceae. There is but one genus in the family represented in America, and 10 species in the genus, though these are to be found collectively from border to border and coast to coast. The plants are more common than ordinarily suspected.	Class Bacillarieae. Order Pennales. Family Fragilariaceae. In *Fragilaria* there is a mucous material connecting the cells into colonies. In some the valves are circular and in others (Pennales) they are usually bilaterally symmetrical. They are attached by mucus or freely floating plankton. Some are motile.	Class Chlorophyceae. Order Ulotrichales. Family Ulotrichaceae. Seven related genera in the U. S. Plants may be attached or free-floating and are usually at maximum development in early spring, with *U. zonata* a distinctly cold water early season species.	Class Chlorophyceae. Order Ulotrichales. Family Protococcaceae. Attempts to make different genera are based on obscure differences in the chloroplast or color-bearing part. Literature will show either name suggested in heading, but *Protococcus* is probably best to use.	Class Chlorophyceae. Order Ulotrichales. Family Coleochaetaceae. Widely distributed through the country with 3 genera in the U. S. and the many species varying from shields to cushions to branched structures. Some live within walls of other algae, or are supported by other algae.
Reproduction is by fragmentation of vegetative parts and by asexual spores produced, one to a cell, from ends of short lateral branches. Sexual reproduction is complicated, involving a fertilization process resulting in a fertilized egg that breaks away to form an intermediate juvenile stage.	Reproduction is largely by cell division, but there is a reproduction by production of asexual spores, and another through production of microspores and other spores that apparently duplicate the usual sexual reproduction pattern at least in essence. Rapid reproduction is mostly vegetative.	Reproduction by cell division, fracture of filaments. Cells may yield 4 motile spores that become free and start new plants or may yield 2, 4, 8, 16 or 32 spores with 4 swimmer hairs that swarm for a day or so. Smaller spores swarm 2-6 days if temperature is below 10°C.	Reproduction by simple cell division. There are no motile spores or sex organs, the plant getting its worldwide distribution by taking to the air and being blown about. Commonly cells may remain together until they can free selves and be blown about.	Reproduction largely by zoospores produced one to a cell and each bearing 2 swimmers. These may be produced at any time of the year, but in spring all cells of an old plant may produce zoospores ending the life of the old plant. Sexual reproduction in most species by union of different sized gametes.
Plants have been found in Lake Ontario to depth of over 150 feet. Plants in shade and in deep water are reddish or deep violet, rather than the olive green of the plants grown in better illumination. The color of the plants can be changed by varying the nature of the light.	Serve a role in water purification and possibly, in some cases, as a pollutant. The silica cell walls do not disintegrate easily and may accumulate in enormous quantities as diatomaceous earths. This is a general observation and not limited to the genus listed above. Deposits 700 feet deep known.	Sexual spores produced in numbers of 8, 16, 32 or 64 pair and pairs remain motile. Fertilized pair yield 4-16 daughter cells that start new plants. Some species that are abundant in spring are uncommon in summer and abundant again in the fall. Others appear only in limited seasons.	Cells have abnormal ability to take up water and so they may add a quick green to bark after a rain following a drought. Some may survive temperatures of 40°C. below zero. In lichens the plants, through ability to make sugars and starch with help of light and water, make the association successful.	Sexual reproduction is so complicated and unusual that plant is popular with botanists because of its behavior. In winter the plant may survive as it is or through reddish-brown, sexually produced, fruit-like bodies near margin of plant, which produce mobile zoospores that take over with the spring.
This "red alga" of fresh waters is representative of the group, which is so abundant in the seas. It apparently has no great economic significance and has not found its way in common literature as a food for fish or wildlife. It is found in springs, brooks and cool lakes and streams, usually in shade.	Serves superior role as shelter for aquatic insects and as food for fishes that eat the ooze and the insects as well. Polishing powders are made from the silica shells. In some cases, diatoms are used in making explosives, in filtering liquids, in strengthening cement and in tooth pastes.	May act as a water pollutant or as a water purifier, depending in part on abundance. May also serve as food for insects, fishes and other animals. Obviously a relatively primitive alga.	*Protococcus viridis* has been considered the world's commonest, most widely distributed alga. Legend about green north sides of trees is explained by its abundance in the damp, shady side of trees as against the dry sunny side. Use as direction finder not wholly dependable, of course.	Probably of no economic importance and of little biological significance except for its reproductive story. The plants are not large enough for substantial food for aquatic organisms, nor can they well be important in pollution or as food for man. They do not injure plants on which they grow.

NAME SCIENTIFIC NAME	CLADOPHORA	OEDOGONIUM	*WATER NET* HYDRODICTYON	VAUCHERIA
DESCRIPTION	Usually attached, branched strings of cells, each of which is rarely more than 18 times its width, but is usually conspicuously longer than wide. Length may be a number of feet and plant feels harsh rather than slimy and lacks the luster of some other filamentous forms.	Relatively large, coarse, unbranched strings of cells that are usually elongate cylinders containing a spotted green sheet (chloroplast) that encloses remainder of cell contents. There is a single large nucleus just within the chloroplast. Reproductive cells conspicuous.	Small, fine, green nets easily identified with the naked eye, floating in masses in relatively still water with the sides of a hole in the net usually composed of 5 or 6 cells but varying from 3 to 10. Nuclei appear in multiples of 2, and adult cells have large free space and varied chloroplast.	Common as a green felt on flower pots in green houses, or as floating or attached mass of branching strings which do not have crosswalls. Mats are dense and weak and usually pale yellowish-green and slimy. There are many nuclei and the color-bearing bodies are many and toward outside.
RANGE AND RELATIONSHIP	Class Chlorophyceae. Order Ulotrichales. Family Cladophoraceae. May be found in Lake Ontario to depth of 150 feet (*C. profunda*). Two genera are represented by branched and 2 by unbranched filamentous forms. There are 7 species of *Cladophora* found in western Great Lakes area.	Class Chlorophyceae. Order Oedogoniales. Family Oedogoniaceae. We have the one family in the order. The three genera in the family include the unbranched *Oedogonium*, the bristle-branched *Bulbochaete*, and the bristleless, branched *Oedocladium*.	Class Chlorophyceae. Order Chlorococcales. Family Hydrodictyaceae. There are 4 genera in the family in U. S. and 2 species in this genus, *H. reticulatum*, the commoner, making nets up to over 1 foot long, and the brittle *H. indicum* of the West with 1-inch cells, though identification as *indicum* not established.	Class Chlorophyceae. Order Siphonales. Family Vaucheriaceae. There are 7 groups of the genus of which 4 are found in U. S. The differences being based largely on the shape of the sperm-producing organ. Reproductive organs are separated from plant body by cell walls naturally.
REPRODUCTION	Vegetative reproduction by fracture of filaments and division of cells. Some cells may produce many free-swimming spores that can develop new threads. Still others may produce free-swimming spores that unite in pairs and develop new threads. Resultant fertilized gametes are outside parent cell.	Vegetative reproduction by simple cell division. Some cells free motile cells that establish new plants without mating. Others free many small male motile cells that fertilize egg that occupies single cell, or develop dwarf male plants that develop sperms that fertilize the egg.	Vegetative reproduction by fracture of nets. At daybreak or early morning cells may free motile zoospores that form new net in old, whose walls then disintegrate and net enlarges. Sexual reproduction by motile cells that unite outside parent cell and free from 50 to 100 zoospores after rest.	Vegetative reproduction by breaking of strands. Sexual reproduction by 2 adjacent protuberances the female bearing one egg and the curved male yielding many small motile sperms that fertilize the egg. Fertilized egg develops thick wall and may go into resting stage of many months.
ECOLOGY	Some, like *C. glomerata*, are perennial, while others have different seasonal habits. At least one is to be found as a component part of a lichen. Most are common, recognized as long-branching strings attached to stones at the bottom of streams. Chloroplast may be a sheet, net or other type the length of the cell.	Transferring plant from natural solution to distilled water or vice versa stimulate spore production. Plants stimulated to activity by being kept in darkness and then brought to light. Sperms live up to 2 hours and produced most abundantly 12 M. to 4 A.M. and early P.M.	Probably not of importance economically. Must be some association between light and reproduction because of the pattern followed. The zoospores formed in the sexual pattern form net within their original cell before being completely freed by disintegration of cell wall.	*V. hamata* is a spring annual. Some species found in garden soil, some on stones under ice, some in thin mats at bottom of shallow springs. Sperm swarming period is short, and in *V. terrestris* is lacking. Bringing land forms into water, aquatic forms into darkness induces formation of swimmers.
ECONOMY	May serve to help aerate water, as food for insects, fish and other aquatic animals and may contribute to the slipperiness of stream bottoms. Provides shelter for some small water animals and anchorage for others. Some may appear as green balls around bubbles in great numbers on lake shores.	Species are spring, summer or autumn annuals. Iodine causes blue color in cells, indicating presence of starch. In India the plants are dried and sold as food. May be a pollutant of water and serve as food for insects that feed fishes or directly as fish food.	Of more interest to botanists and general naturalists than to economic minded folk. The nets may be eaten by aquatic animals such as insects, fishes, ducks and other animals. The nets are always intriguing, usually because so few persons notice them.	Some forms moved from running water to still water will respond by producing swimming spores. Sperms are usually freed shortly before daybreak. In some the male or female sex organs are borne on separate stalks but usually near each other. Zoospores need not go through fertilization.

ZYGNEMA	SPIROGYRA	DESMIDS *Closterium*	*STONEWORT* CHARA	*STONECROP* NITELLA
Unbranched, green, slimy strings of cells free-floating or attached at one end. Cells varying from equal in length to width to many times as long as wide. Each cell contains two star-shaped green chloroplasts that lie either side of the nucleus and have conspicuous centers.	Usually bright green, slimy, unbranched strings of cells that are longer than wide and contain 1 to 12 green spiral bands (chloroplast) together with a nucleus that may not be easily visible under a microscope under ordinary conditions. Hand lens may show spiral chloroplast sometimes.	Microscopic and of almost all imaginable shapes, but all with cell walls with vertical pores through them. Most are unicellular with one chloroplast to a section. Closterium resembles a slender, two-pointed horn with an obvious division across the middle, or like two slender cones placed together at their bases.	With stems 8 or more inches long, bearing double whorls of leaf-like structures with 8 to 10 leaves at a joint, coarse, usually brash because of heavy encrustation with lime. The stem covered by layer of long cells extending from one joint to the next, or broken at intervals by smaller cells.	Usually slender, smooth, erect, attached plants with whorls of "leaves" at joints with the sections between joints 2-4 times the length of the leaves or branches. Stems not covered with layer of long slender cells as in *Chara*. Branches at joints may be divided or undivided and are to 8 at a joint.
Class Chlorophyceae. Order Zygnematales. Family Zygnemataceae. There are about 14 species of the genus to be found in the United States, usually associated with *Spirogyra*, but in southern California *Zygnema* is usually the more common. We have 9 genera representing the family.	Class Chlorophyceae. Order Zygnematales. Family Zygnemataceae. In the U. S. there are over 65 species of Spirogyra and at least 9 genera in the family Zygnemataceae in the U. S. Reproducing strands show H-shaped cells connecting two parallel strands with some empty cells.	Class Chlorophyceae. Order Zygnematales. Family Desmidaceae. Differences in genera and species are based entirely on the shape and structure of the vegetative cells. Symmetry seems to be the pattern on which desmids are built, in spite of their obvious complexity in details.	Class Chlorophyceae. Order Charales. Family Characeae. Much controversy centers on the place of these plants in the plant kingdom. The related *Nitella* lacks the cell covering on the stems described above. Does best in hard water environment and may sometimes be taken as index of alkalinity.	Class Chlorophyceae (or Charophyceae according to some). Order Charales. Family Characeae. There is but one family in the order and 2 genera in the family. Some authors have proposed that the plants are a distinct class of algae belonging near the mosses because of the character of the sperms.
Vegetative reproduction by cell division, each cell getting a chloroplast, which then divides, or by breaking of filaments. In some species sexual reproduction effected by joining of cell contents of pairs of cells in parallel-lying filaments forming colored resting cell.	Vegetative reproduction by simple cell division and filament fracture. Sexual reproduction by joining of contents of two cells to form a "zygote," which may act as a resting stage. Species differ in time of maturity and reproduction not so much as environmental but maturity causes.	Reproduction is usually by simple cell division, or sometimes by production of spores. Sexual reproduction takes place following the joining of two free individuals, the union of their protoplasm into a common mass, which eventually develops into new units.	Reproduces by fracture of the stem or by a sexual reproduction associated with vase-like or long egg-like structures borne in the leaf axils. Cells bearing male or female elements are found on a single plant and may be visible to naked eye. Sperms borne in long, coiled, slender threads with crosswalls.	Reproduction is by fracture of the vegetative parts and by sexual processes. The egg bearing structure in *Chara* is capped by 5 cells; in *Nitella*, by 10 cells. The egg-bearing cells are enclosed by a twisted sheath of cells and may become dark brown when mature and be easily seen with the naked eye.
Lateral joining of cells due to heredity not to environment. *Z. stellinum*, *Z. leiospermum*, *Z. insigne* are spring annuals and in permanent ponds *Z. pectinatum* is a perennial. There is one terrestrial species, *Z. peliosporum*. In some species one cell loses content to another.	Spring annuals include *S. catenaeformis* and *S. protecta;* summer annuals *S. nitida*, *S. setiformis*, *S. irregularis* and *S. ellipsospora*. Iodine may cause blue spots in cells indicating starch presence. Oils also may be recognized as well as clear spots.	At their best in waters with a pH of 5 to 6. Desmids may be observed in aquaria making their way towards the lighted side by means of a series of jerks, probably in part due to secretions of gelatinous materials. The vacuole at the end of each cell in *Closterium* contains one or more granules of gypsum as balancers.	Definitely associated with presence of lime. When drying on a boat or shore gives off characteristic odor. Often found over marl bottoms, and may contribute to the deposition of lime and the build-up of a marl deposit. Listed as food for moose, deer, waterfowl in many references.	*Nitella* is much more slender and fragile than *Chara*. Both provide shelter and are rich producers of fish food, particularly for trout and bass. Both have a softening effect on water taking from it lime and carbon dioxide and assisting in the production of marl. Has characteristic odor.
A pollutant like *Spirogyra* with most of the general qualities of that genus. It is eaten by insects and by fish and even by squirrels and other mammals on occasion. Records of use as food by man seem to be lacking, but it would be only incidental and unusual, anyway.	A water pollutant either found free-floating or attached. Normal length of vegetative cycle is variable. Has some value as fish food and as food for insects that are fish food. In India some species are collected, dried and sold for use as human food.	Of little if any economic importance. May make up a portion of plankton in a waterway, and plankton has food value for organisms that may have food value for man. Of primary interest to botanists and a great challenge to some microphotographers who become intrigued with the beauty of the symmetry of the plants.	Aside from value to wildlife as food and shelter for smaller food animals, it has been demonstrated with some success that mosquito larvae growing in water that supports *Chara* in abundance in small pools do not reach maturity. Plant may serve thus as a check on mosquito populations at times. See *Nitella*.	Economic importance much like that of *Chara* and as suggested above may be associated with fish. Some waterfowl feed on these plants, possibly because they usually abound in small animals which with the plants give a mixed and useful diet.

(Continued from page 27)

streams. When stream managers wish to start fresh with the organisms in a body of water they frequently kill off the existing population with copper sulphate, and start all over again as soon as it has been washed away.

Modern pond management designed to produce fish for the farmer's table is essentially a matter of managing fresh-water algae. A plankton population is maintained at such a level that it blots the light from the deeper waters and prevents the development of larger water plants, which might clog the pond and hinder the activities of fish. This is a fine example of exact management that has been developed in recent years, and is each year being improved somewhat. This management is largely effected through so feeding the plankton organisms as to maintain the desired balance between plants and animals and the desired population in the desired places.

How Fresh-water Algae Live: The average high school student who has had a basic course in biology has been exposed to the life history of algae, possibly much to his annoyance. Of course, freshwater algae must have the basic conditions that maintain life. They must have water, oxygen, light, suitable temperature and suitable chemical environment. With these we can hardly be concerned here. We can point out the variations that are obvious in the prosperity of algae in regions of different light intensity and in waters of different temperature. We can point out that, even in garden soils, conditions may be suitable for the growth of some algae, and that their presence there may add to the economy of those soils.

Given suitable physical conditions, our algae will grow. Growth varies with the groups, of course. To all, development of the vegetative body is important. Some of the simpler algae do not develop beyond this. The higher algae, however, may develop special cells that yield special motile spores, which can move about at will and establish new plants. This is a quick way for a species to occupy suitable territory, or to recover from diminution. Still further, we have the sexual reproductive technique, which makes the eyes of the academic botanist gleam and which really does provide a most interesting vehicle for appreciating the evolution of the reproductive process in any organism. The mental discipline involved in mastering this story is not appreciated by the beginning botanist, but never fails to intrigue the one who has gained an understanding of the basic idea.

The details provided in the illustrations, in the tabular material in this insert, and in the average botany text should make it unnecessary for us to pursue this angle farther. At times the story has been touched on in Dr. Corrington's excellent articles dealing with the use of the microscope in biology.

CHARA

NITELLA

Classification of Algae: Fresh-water algae, like other organisms, may be classified according to their relationships, according to their ecological nature, according to their economic importance, and otherwise.

Botanists generally recognize seasonal groups as follows:

Winter annuals may begin development in autumn and continue developing from November to April, reaching a reproductive climax in March and April. Examples are *Vaucheria sessilis* and *Spirogyra tenuissima.* These may be found when this insert is first published.

Summer annuals germinate in spring and reach their greatest degree of prosperity in July and August. They produce asexual spores most abundantly in spring and summer, and sexual spores most abundantly in August and September. Examples may be found in the chart section.

Autumn annuals begin development in late spring and reach their maximum abundance in late autumn.

Perennials, as the name implies, may be found in full vegetation at almost any time of the year. They usually are at their best in sexual reproduction in May and June.

Ephemerals are those species that may complete their vegetative cycles in a few days or weeks, and may do this at any time of the year when the physiological conditions suit their demands.

Classifications based on hereditary relationships provide a field day for the botanists working in this field. It used to be simple to classify the algae as blue-green, green, brown and red. Our insert on sea-weeds introduced you to many red algae and brown algae, and to some green algae, because these groups are most conspicuously represented in the sea. This unit on fresh-water algae omits consideration of the brown algae because the group is essentially marine. It includes one red alga because at times some of these species may be conspicuous and may supplant other algae. This leaves us free to emphasize what we formerly considered as the blue-green and the green algae. I have on my desk beside me six books on algae published in the last few decades, but with little agreement as to what the major groups may be. The order in which these are considered in the books varies and is radically different from the order in which they were considered when I was a student, and, later, a college professor of botany. I have tried to recognize a conservative classification here and will leave it to you to get it from the second section in each of the life histories given under the head of relationships.

Citizens to Confer

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CALLED jointly by President Truman and President-elect Eisenhower, a citizen's conference on the conservation and development of natural resources will be held in Washington, D.C., March 25, 26 and 27, 1953. The sponsoring organization for the gathering is Resources for the Future, Inc., a new, non-profit corporation established on invitation of The Ford Foundation to support education and research in the field of conservation.

Not since 1908, when President Theodore Roosevelt, taking advantage of the first Governor's Conference, called a White House Conference on conservation, has such a general meeting been held. Perhaps it should be a source of gratification to those of us who have been working for many years to arouse an understanding and appreciation of conservation that our voices have thus been heard. The American Nature Association will lend its hearty support to the meeting.

The corporation, Resources for the Future, was established by a committee of citizens that accepted an invitation from The Ford Foundation to serve as an advisory group on resources. This group was asked to assist the officers of the Foundation in planning a program, and to work in the field of research and education for resources development and conservation. Horace M. Albright, president of the United States Potash Company and a former Director of the National Park Service, has been named president of the new organization, and Charles W. Eliot, planning consultant and former Director of the National Resources Planning Board, has been chosen as Executive Director of Resources for the Future.

According to Mr. Albright, the new corporation will undertake "long-range programs of research and education to assure the resources essential to the progress, vigor, and security of the Nation." Both the outgoing and incoming Chief Executives of our Nation have given their blessing.

Announcement of the meeting emphasizes that the conference may be expected to give attention to the information on resources gathered by the Paley Materials Commission and the Water Policy Commission, and the recommendations made by the Hoover Commission on Government Reorganization.

Referring to the report of the Paley Commission, Mr. Albright points out that this report showed that "with less than 10 percent of the free world's population and 8 percent of its land area, the United States consumes half the free world volume of materials; that we have completed the transition from a raw materials surplus nation to a raw materials deficit nation and from a net exporter to a net importer of many of our vital materials. We have been 'mining out' our renewable resources — soil, forests and underground water — and restoration, where possible at all, is slow and costly."

According to the announcement of plans for the conference, its theme will be the question: "How Shall We Provide the Resources for the Nation's Growth, Welfare, and Security?" And the scope of the conference is to be "The Conservation, Wise Use, and Development of our Resources." The objectives of the meeting are stated to be three-fold.

First, the conference seeks "to call the attention of the public, industry, and government to the resources problem, its nature, and possible solutions."

Secondly, it aims "to provide a forum for full discussion and better understanding of issues and policies aimed at providing needed materials for a growing dynamic economy and resource conservation and development."

Finally, the meeting will seek "to formulate new objectives and next steps for action by individual citizens, private groups in industry, agriculture and labor, by citizen organizations, and conservation agencies, as well as by Federal and State Governments."

The conference is timed at the beginning of a new administration to "provide an opportunity for a new beginning and a new orientation of public opinion towards the conservation, use, and development of our resources."

It seems obvious, from the announcement of plans for the forthcoming conference, that the approach to the conservation and wise use of our natural resources is primarily from the economic point of view. There is a great area for such an approach, and a great need for the educational and research objectives that Resources for the Future has set for itself. Despite progress in recent years, we still have a considerable distance to go before sound resource-use attains a national conception and policy.

It is to be hoped, however, that the citizen's conference will also consider those natural resources upon which no economic price tag can be placed. By this we mean the esthetic, recreational and spiritual values inherent in such great assets as our national parks, our wilderness areas, and our wildlife resources. Any drive to exploit natural resources that would sweep aside the safeguards thrown around these resources, and the public lands now devoted to their preservation, would be to ignore some of the finest and most valuable resources that we have for the future.

White-fronted, snow and Canada geese feeding in a barley stubblefield on Federal lands in the lower Klamath Basin. This is the most important feeding area in the Pacific Flyway.

The Imperiled Klamath-Tule

By CLEVELAND VAN DRESSER

U. S. Fish and Wildlife Photographs

IN WHAT could well be a paralyzing blow to the greatest migratory bird refuge on the Pacific Coast, a small but determined group of men is seeking its emasculation through a series of pressure moves on the Bureau of Reclamation. These men, members of a veterans' organization, want approximately 18,000 acres of rich land cut up into 80-acre homesteads in the Klamath Basin. If the Bureau of Reclamation decides to do the carving, the migratory bird refuge, known as the Klamath-Tule, on the Oregon-California border, will be reduced to a pitiful remnant.

It is a somewhat anomalous economic setup whereby an entire community, dares not speak its mind. Sportsmen for a thousand miles down the West Coast are vigorously protesting against the impending vivisection of the refuge. So far they have been instrumental in obtaining a delay in the proceedings. To have a migratory bird refuge carved up and given away piecemeal is discouraging enough to conservationists, but to have it happen to the Klamath-Tule verges on the disastrous.

It is hoped that a clear picture of the situation will change the opinion of the Reclamation Service in Washington, which at the present writing appears inclined to bow to the wishes of a loud, strong minority.

To say that the Klamath-Tule refuge is the greatest migratory bird sanctuary on the west Coast is no exaggeration. Situated as it is, ducks and geese simply *must* use it on their annual north and south migrations. So far as bird flights are concerned, it forms the base of a Y from which come and go the huge migrations up and down the entire Central Valley of California. The refuge is hemmed in on all sides by mountains, forests and desert. There is no stopover area for waterfowl for 200 miles in any direction. As one eminent biologist recently put it: "As goes the Klamath-Tule, so goes the Pacific Flyway." He is absolutely right.

The refuge area was originally 180,000 acres. It has been cut down by agriculture, and draining by the Bureau of Reclamation, to about 60,000 acres. In reality Klamath-Tule is two bird refuges, the Lower Klamath and the Tule, each separated from the other by a nine-mile mountain ridge. Each refuge, roughly 30,000 acres in extent, is half water and half land. The water is controlled by an extensive system of dykes. The land is planted to barley, rye and oats.

During peak migrations the water areas can scarcely accommodate the tremendous flocks of ducks and geese that use them. There is hardly sitting room on the water, let alone enough aquatic plants for food. I

made my investigation late in August, before the big flights had started to arrive. Even at that early date, I have never seen such massed waterfowl populations anywhere. Unless you have seen it, you can scarcely credit the fact that between six and twelve *million* birds use the Klamath-Tule every year! And thousands of ducks and geese nest there annually.

The land areas of Klamath-Tule are just as important as the water areas. For it is upon these 30-thousand-odd acres that the cereal crops are grown that feed vast hordes of these waterfowl. Every foot of land surrounding the Lower Klamath and the Tule is farmed to the limit of its capacity. Even the Fish and Wildlife Service is in the farming business, for it maintains strips of cereal crops adjacent to the water's edge. These crops are left standing for the exclusive benefit of ducks and geese. The rest of the land is harvested either by private owners of part of it, or by permit arrangement with farmers who operate huge tracts controlled by the Bureau of Reclamation.

White-fronted and snow geese flying across a country road in the northern end of the Klamath Straits Unit toward the Lower Klamath Refuge. This is typical of the many migration flights.

As a rule, harvests are reaped before the birds arrive. To preclude crop depredations by early bird arrivals or because of late harvesting operations, farmers are permitted to scare off the birds with shotguns. No killing is permitted out of season, or on "no-hunting areas." The arrangement, on the whole, is perfectly satisfactory to the farmers.

What will happen to the Klamath-Tule if it loses 18,000 acres of land to homesteading is amply demonstrated by the sharp divergence in farming practices between private land owners and lease farmers of the region. The private land owner invariably burns or plows under his fields immediately after harvest. He leaves no stubble for waterfowl. The permit operator, on the other hand, leaves the stubble untouched; he has to as part of his agreement with the Bureau of Reclamation. This stubble yields four bushels of grain to the acre.

Eliminate 18,000 such acres and you cut the food supply of ducks and geese so drastically that the refuge will support but a fraction of the birds it does now.

If the homesteading of the 18,000 acres in the Klamath Basin would benefit large numbers of people, there might be some sense to the proposed program. But it does exactly the opposite. At most, fewer than 250 persons will benefit by such homesteading, for that is the maximum number of farms that will result from slicing up the 18,000 acres. Such slicing up of the land will in no way increase the agricultural output of the Basin. In fact, it will cut it down by at least ten percent in land taken out of production by houses, barns and roads. Furthermore, homesteading will absolutely eliminate the entire public shooting area that abuts the refuge in Oregon. It will do virtually the same thing in California, or so reduce it that hunters will be shooting one another instead of waterfowl.

When a man obtains a homestead it is his land and he does what he pleases with it. If there is to be any duck hunting in the Tule Lake area, the homesteaders will have it all, provided, of course, Reclamation gives them the land. What happens on private land adjacent to the Klamath-Tule refuge is amply illustrated by what takes place on the relatively small tracts of such lands right now. Private land owners charge five dollars per person per day for the privilege of standing on their property and shooting at ducks and geese.

What makes the situation worse from the conservation standpoint is that sanctuary areas will be included in the homesteading. The land area surrounding the refuges will become one solid shooting ground (with the exception of narrow strips of crop land farmed by the Fish and Wildlife Service) and the kill will be raised far above the point of tolerance. The birds will be hemmed in a very small area from which there will be little chance to escape.

The proposed carving up of the 18,000 acres will be a knife in the back of thousands of sportsmen, many of

them veterans, who come to the Klamath Basin every year (five thousand on last opening day). With public shooting gone, they will have to pay through the nose to get on the same land, if it is homesteaded. Duck hunters being what they are, a few of them will undoubtedly do just that, and where does that leave the policy of "the most good for the greatest number?"

It is a better than even wager that the homesteader will reserve shooting privileges to his friends or heavily paying "guests." And when you consider that sanctuary areas, now closed to all shooting, will be opened up by homesteading, you have a pretty dismal picture of the future of the Klamath-Tule migratory bird refuge.

On top of this, the entire population of the town of Tulelake will suffer if the proposed homesteading goes into effect. Owners of restaurants, hotels, filling stations, motels and other businesses in the town make operating expenses for an entire year during 70 days of the migratory bird hunting season. Tulelake is hunting headquarters for the Klamath Basin. And yet the town is almost 100 percent behind the proposed homesteading program — on the surface, that is. Despite the fact that almost everybody in the Klamath Basin — except the 250 persons who will get tracts of land — will suffer economically from the proposed homesteading program, they are all for it.

Such a situation seems idiotic, until one probes behind the scenes. The preponderance of persons living in the area are members of a veterans' organization. If the homesteading program is adopted by the Bureau of Reclamation, the only persons who will be awarded the tracts of land will be veterans. Those farmers who now operate under lease arrangement with the Bureau of Reclamation are all veterans. The veterans' organization has decided it wants the Bureau to homestead the 18,000 acres. Ergo, everybody in the Klamath Basin is behind the idea and the pressure being built up is great.

The local weekly paper — owned by a veteran — is loudly in favor of the plan. As its editor recently said, in substance, in his pages: "The Bureau of Reclamation is supposed to reclaim and homestead the land. Let's have the program go through and to hell with the ducks."

Evidence that there is a definite undercurrent of opposition to the plan was made clear to me in a sub rosa conversation I had with a hotel owner in town. He said he was against the idea, but he could not say anything about it out loud. He, too, is a veteran, and the organization runs the Klamath Basin as far as local affairs are concerned.

What makes the position of the veterans' organization even more untenable is the fact that a large proportion of the hunters who annually come to the Klamath Basin are also veterans. How can the organization justify a homesteading program that will harmfully affect thousands of its members while benefiting a mere 250?

Even to an impartial observer, stripping the Klamath-Tule bird refuge of its bare essentials for the benefit of less than 250 persons seems inconceivable from an economic standpoint. From a conservation standpoint, the refuge cannot stand being crippled. During the past 50 years the natural waterfowl area of the Central Valley of California has been reduced to ten percent of its former extent. The original area was 6,200,000 acres. Ninety percent of it has been drained and turned to agricultural purposes.

In order that ducks and geese may survive, let alone occur in abundant numbers, part of that agricultural land must be reserved for feeding purposes. It is a surprising and gratifying thing that migratory waterfowl, principally mallards, pintails and geese, will feed upon stubble fields. If they had to depend upon foods available in the reduced water areas, they would starve to death.

Broadly speaking, homesteading of the Klamath-Tule area will benefit nobody. It does not increase the agricultural output of the land. Indirectly it harms thousands of people. Even in the critical, cold light of economic returns, ducks and geese have a very tangible value. To destroy that value and gain practically nothing in return simply does not make any sense.

If homesteading is desirable and necessary, let the seeker thereof turn to other regions. There are vast tracts of land being made available by the Bureau of Reclamation in the Columbia River Basin. In such areas the waterfowl situation is not so critical as it is in the Klamath Basin.

Homesteading the Klamath- (Continued on page 52)

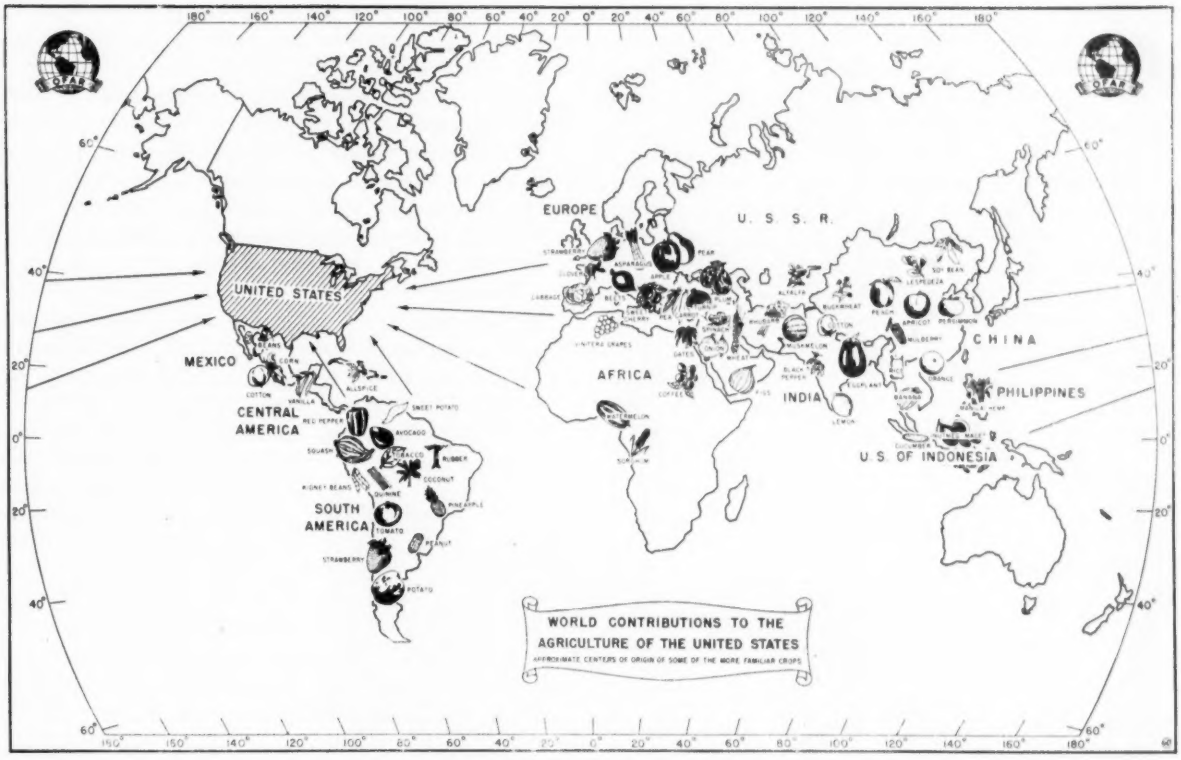
Strange Beacons

By ELLA ELIZABETH PRESTON

Out through the bleak and baffling night they flew,
A wedge of wild birds crying,
A strange light flying
Leapt from earth's rim, a rapid, silver arc
Carving a bright slash through the secret dark
Before them lying.

Onward they flew, yet came forevermore
Above the island sighing
Curled in its sleep against the river's shore.
With frantic flying
They could not pass it, for the maddening light,
A slender pencil, mocked them in their plight
Tracing false highways through the frosty blue.
Instinct forsook them. Strength forsook them too.

Long, long I listened through the bitter night
To hear the wild birds crying,
My spirit flying,
Aching to comfort them. For I, too, know
The numbing terror where strange beacons glow,
Old faiths denying.



They Also "Bring 'Em Back Alive"

By JAMES NEVIN MILLER

U. S. Dept. of Agriculture Photographs

AMONG his colleagues at the Department of Agriculture, William E. Whitehouse, a Massachusetts horticulturalist with a doctor's degree from Maryland University, is known as the man who introduced to America "the onion with the loose collar."

This may sound a bit frivolous, but it was a serious achievement. For years the Texas onion industry has been threatened by a tiny, thrip-like insect that digs deep into the tight collars of the young onions. The pest has defied all insecticides because it can dig deep enough into the tough collars to escape all control measures. But Dr. Whitehouse found a way to outfox the winged gangster. On a trip to Persia, a few years back, he found a species of onion with a collar so loose that the insect cannot do its dirty work, since there is no protective collar to offer it a safe hiding place. Plant breeders have now bred this loose collar characteristic into a revolutionary type of onion that literally is saving the Texas onion industry.

Dr. Whitehouse serves the Department occasionally as a member of a little band of plant explorers. Without the accomplishments of this group many of the fruits, vegetables and grains you eat every day would not be nearly as flavorful, long-lasting, or able to grow abundantly under America's great extremes of temperature and climate.

These plant hunters are the men who "bring 'em back alive" in the plant world, just as explorers for the zoos and museums do for their wild animal exhibitions. But the discoveries of the plant hunters are not for mere exhibition purposes. Their quarry is sought to improve the nation's foods, farms and gardens.

Since this type of exploration first got official sponsorship from our Government back in 1898, plant explorers have given the United States more than 200,000 varieties and strains of fruits, vegetables, grains, grasses, trees and ornamental plants.

For many years the explorers worked for the Office of Foreign Seed and Plant Introduction. This office, now known as the Division of Plant Exploration and Introduction, is administered through the Bureau of Plant Industry, Soils and Agricultural Engineering, U.S. Department of Agriculture.

During the twentieth century, agricultural development of intensive and extensive crop production has introduced new problems and needs for new plants. We also need genetic characters to be found in the wild ancestors of our cultivated plants in order to combat

disease, insect, and environmental problems. Plant exploration has become a diversified yet specialized business to service the demands of the research men in plant pathology, breeding, physiology, agronomy, horticulture, and other fields of pure and applied botanical sciences. Recent research in the hormone field and with antibiotics has indicated that the plant world is practically untouched from the standpoint of extracting phytochemicals for the treatment of human diseases and for general use as antibiotics.

Four explorers, all botanists, are out in the field now. Two of them, Howard S. Gentry and William B. Fox, are in Mexico, seeking plants that can be used as sources for the anti-arthritic drug, cortisone. A third explorer, Robert K. Godfrey, is in Turkey, searching for wind- and water-resistant forage plants for the Rocky Mountain States. A hoped-for ultimate result of Dr. Godfrey's trip is to build up our potential in beef and dairy products. The fourth explorer, Allen A. Beetle, is on a similar quest in South America.

An early plant safari on a mountain top in China. The United States' plant explorer is shown with his mule-and-donkey caravan near a high pass.

Incidentally, Dr. Gentry, a native of southern California, is the only "regular" among the plant explorers. The others, most of them in their early forties, are borrowed from colleges and research agencies from time to time. Dr. Gentry and Dr. Fox, his botanist associate from North Carolina, have been traveling steadily in Mexico for two years. Already they have sent back a number of plants that show promise. Outstanding are certain Mexican wild yams and agaves, the latter slightly resembling the yucca plants grown in many American back yards.

Another explorer who has traveled extensively in Mexico is Donovan S. Correll, a North Carolinian educated at Harvard, who has been a Department botanist for eight years. Dr. Correll's immediate quarry is disease-resistant wild potatoes, and he recently wrote a monograph on the subject.

Then there's explorer James L. Stevens, an agronomist from Georgia, who, in 1947, brought in new strains of Bahia grasses from Argentina and Brazil. These promise to rate among the most important hay grasses for our extreme southeastern states.

Plant scientists have nicknamed Turkey "the original Garden of Eden" because so many of our vegetables and crops originated there. Therefore, when a plant explorer visits this important center of economic plants he usually is instructed to pick up "everything in sight." In 1949 explorer Jack Harland, an agronomist from Oklahoma, was given such a scientific blank check. Of the many plant specimens he brought back, one, a celery species, is outstanding. Tests made by Department plant breeders at Lyons, N.Y., indicate this species, because of large, firm stock and superior flavor, may be the best this country has ever imported.

On this same trip to Turkey Dr. Harland found a type of corn that has a characteristic of male sterility much desired by plant breeders. As is well known, today most of our corn is hybrid seed corn. Such corn has to be bred every year to produce new seed. Plant breeders, in order to be certain they get the right corn characteristics, have gone to the time and trouble of always taking the male tassels off the corn that they do not want in the cross. If this characteristic of male sterility can be developed properly, the result will be a corn that need not be detasseled because the male part of the corn will be sterile already.

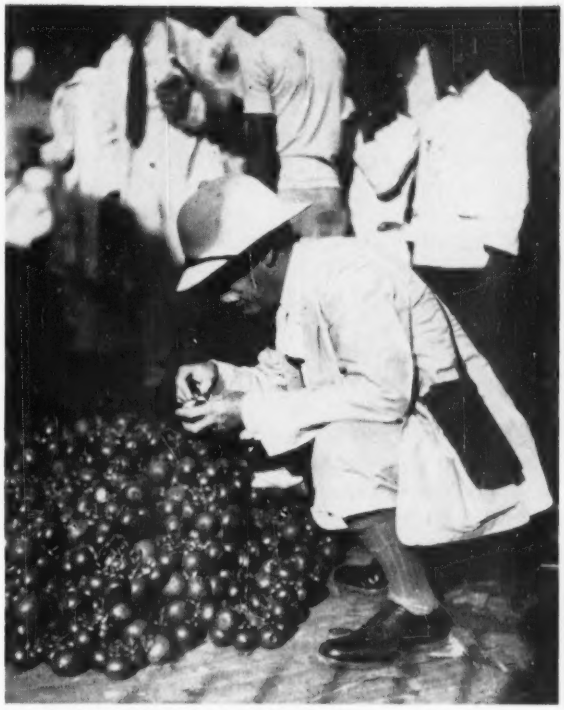
On a trip to India in 1948 explorer Walter Koelz, a Michigan botanist, brought in three plant specimens, all of which have been carefully tested and show great promise. One is a muskmelon, extremely resistant to the disease of downy mildew. Another specimen is a cucumber that is immune to anthracnose, one of the worst cucumber diseases. The third specimen is an alfalfa that is hairy in its stems and leaves. The alfalfa appears to be valuable for breeding purposes because the thick hairs keep away a certain type of destructive leaf hopper. The sucking habits of this insect pest have ruined many hundreds of acres of alfalfa in our central and eastern States.

A search that seemingly will never end, calls for more and better grasses of two main kinds — for soil conservation purposes, and for forage. Of the former type, centipede grass is outstanding. The great pioneer explorer, Frank Meyer, brought in the first of eight introductions in 1918. Centipede is valuable as a soil binder on the banks of drainage ditches. Because it protects the steep sides of ditches with a resistant sod, the grass is widely grown in our southeastern States, especially in the swampy areas around Savannah, Georgia.

Of the imported forage grasses, many wheat grasses from Russia, of which crested wheat grass is best known, have been found valuable for our dry northwestern states, where no native grass has proved satisfactory for spread as a cultivated forage. The original strain of wheat grass was imported in 1898 by N. E. Hansen from Saratov, on the Volga River. This forage crop has now become perhaps the most important of all range and grass-hay crops in the Northwest. In 1944, 165,000 acres of crested wheat grass were grown in the area. This acreage produced 17 million pounds of seed alone.

Today the most important hay crop among our cultivated grasses is timothy, grown mostly in the eastern half of the United States. Our early settlers first brought timothy here from northern Europe, where, oddly enough, it was not a commercial crop. At Wooster, Ohio, the Department of Agriculture maintains a collection of wild timothy stems for breeding purposes. Since 1898 the plant explorers have contributed 260 introductions to this collection. These came from various parts of the world, but mainly from northern Europe. In 1951 the total timothy acreage in the United States was twenty-one million.

A Manchurian farm hand harvests a soybean crop. The father and son team of Dorsett and Dorsett brought back soybean seeds, and soybeans are now one of our big money crops.



Dr. David Fairchild, early government plant explorer, first head of the Division of Plant Exploration and Introduction, examines and samples a mangosteen in a market at Medan, Sumatra.

Another imported grass, lately of great value as a hay, is Russian wild-rye, first sent here in 1927 by a Russian professor. Since then many strains have been introduced by explorers. In 1941 the seed was released to the general public. Today this grass is widely used for planting in North and South Dakota.

Many people may not think of bamboo as a grass, but it is. Thus far this native of China is little known as a crop here. But those in the know are optimistic that bamboo will become an important crop within a decade, not only for use as paper pulp, but as a vital structural material for building homes, schools and factories.

Strains from sixty species of bamboo have been brought in during the past fifty years. Horticulturalist R. A. Young, now retired, was one of the big factors of the bamboo introduction program, which developed real impetus as early as 1915. Bamboo is now being grown extensively at the Federal Plant Introduction Station at Savannah, Georgia. Our plant breeders are convinced that the best "temperate" bamboo, that is, the kind that will grow well throughout our semi-tropical areas, can flourish, if scientifically produced, in all the southeastern States.

Lespedeza, a clover-like plant, but not a grass, is widely used for hay and forage. Many precious strains

A great plant explorer on the job in Korea in 1929. W. J. Morse looks over a bed of lespedeza seedlings at an experiment station near Chosen.

were imported by pioneer explorers Dorsett, Norton and Morse from central and northern China. For our purposes the outstanding strain is the one called Korean lespedeza, first introduced here in 1919 by a missionary, Rev. Ralph G. Mills. He brought in a mere handful of seed, but it paved the way towards revolutionizing the agriculture of Missouri and other south-central States. It gave these States a priceless winter cover crop. Today Korean lespedeza, grown for seed alone, is worth $20,000,000 a year. As a hay crop the plant has an estimated annual value of $100,000,000.

Other nations continually call upon our plant introduction scientists for advice and direct help. In 1951 our government sent 11,260 plant strains and plantings to 76 countries. United States' breeders have developed important varieties of hybrid seed corn that are now being used extensively by Italy and South Africa. Two potato varieties developed here have proved ideal for farmers in Greece. In addition, the plant explorers, while criss-crossing all over the world, have spread pecans, blueberries, raspberries, and others of our native plants, almost everywhere.

Plant introduction was given stimulus by the Research and Marketing Act of 1946, which embodied the following excerpt:

"... to encourage the discovery, introduction and breeding of new and useful agricultural crops, plants and animals, both foreign and native, particularly for those crops and plants which may be adapted to utilization in chemical and manufacturing industries."

Under this program, starting in 1948, funds have been made available to the Division of Plant Exploration and Introduction to establish a national cooperative project for introducing, testing, evaluating plants.

The introduction of plants for industrial uses involves not only the usual horticultural and agronomic tests but also the added problems peculiar to making produce into a product. Many questions arise. For example, are the costs of production prohibitive? Many crops that produce valuable chemicals, such as pyrethrum, can be grown successfully in the United States. But costs of land, labor and processing the chemical are too high to compete with the lower costs in Japan or Kenya Colony in Africa.

For about 300 years our agriculture has expanded to a point hardly envisioned by even the most forward-looking of our founding fathers. Even so, insects, climate and ravages of disease are always working against us. The plant explorers must continue to look for plants that are resistant to new diseases and insects. We are a quality-conscious nation and we must continue to seek those quality factors that meet the increasingly high standards of our consumers.

Craftsman *By* DORIS V. SMILEY

How versatile a craftsman is the spider!
Engineer and weaver, he designs
With equal ease, the filmiest of textiles,
A bridge's taut, coordinated lines.
To spruce-trees' green, wide-skirted branches
He adds a flounce of finest lace, and then
Along a bridge whose trusses were erected
Through long, hot hours by many sweating men
He casually extends a length of cable,
Anchors it securely into place
And, skilled in fundamental strains and stresses,
Reinforces center, top and base.
Noiselessly he rivets strut to girder;
With little effort finishes the span
As if, with tongue in cheek, belittling
The time-consuming drudgery of man.

Show Your Treasures in Boxes

By WARD B. HOLT

Donna shows the boxed arrowheads. The box at the left has been removed from its cover for viewing, while the other was merely turned over in it, thus keeping all three parts together.

EVEN a helter-skelter pocketful of arrowheads can be mighty nice to have, but arranged as a neat and purposeful display it may become a treasure. I know, because I have just mounted our own loose pocketful in four little boxes. This sort of task is more or less up my alley, for building museum exhibits used to be a part of my daily work, yet the extent to which those arrowheads gained in charm through proper presentation surprised even me. And, aside from a bit of spare time, the cost of the job approached zero.

The key to success in my small undertaking lay in the fact that I stumbled upon a box superbly right for the purpose. Most of the amateur mounts that friends have shown me seemed either too elaborate or too crude, or — one of the commonest of faults — I felt that they crammed too many arrowheads into a single space. Personally I think that ten is about the upper limit; exceed that number greatly and individual arrowheads tend to become lost in the crowd. So I sought a small, neat and unpretentious container, and found it in the boxes used for packaging photographic sheet films.

Better boxes than these for the purpose could hardly be devised, for they are stoutly built, pleasingly proportioned and shallow. Furthermore most manufacturers make them in three parts — the conventional lid and bottom portions, fitting together like the top and bottom of shoe box; and third or inner section, similar but slightly smaller, that slips inverted into the bottom part. This third section is their crowning triumph, for it may be converted into a window frame to carry a protective pane of transparent plastic.

Sheet film is supplied in a wide range of sizes, the popular 4 x 5s and 5 x 7s being packaged, either 25 or 100 films to the box. For my purposes I chose the shallower 25-film boxes in the 5 x 7-inch size. This size will accommodate an arrangement of eight or ten arrowheads without appearing either crowded or too vacant.

To prepare a box I first slipped out that inmost section and, with sharp pencil and straightedge, outlined on its bottom the window panel that I wished to remove. I spaced my lines a little more than a quarter-inch in from the long edges and a trifle farther from the ends. This left enough of the bottom in place both to preserve the stiffness of the piece and to serve as a frame for the prospective display. Round corners were drawn around a dime. To cut the panel out I used a freshly sharpened pen-knife, with straight-edge and dime as guides. A piece of glass propped firmly beneath

Preparing the boxes as described in the accompanying article. This manner of boxing arrowheads may be applied to a variety of kinds of specimens.

the cardboard gave the point of the knife a hard surface to bear against, insuring a clean cut.

After removing the panel the cut edges were blackened with India ink (and the entire bottoms of some boxes would have to be blackened.) Then a pane of plastic, clipped from one of the transparent sleeves that photographers and stationers sell for the protection of photographs, was secured beneath the opening with Scotch tape, and this portion of the box was complete. It remained only to re-cover the printed lid of the film box with a pleasing paper (metallic papers offer the advantage of washability) and I had my display case.

The arrowheads could, no doubt, have been mounted directly on the bottom of the film box, but I thought it better to cut a piece of stiff poster board small enough to permit that third or window section to fit loosely over it, and then arrange them on its white side. Needless to say, the arrowheads for each group were selected with care and laid out in pleasing lines that the eye might follow readily. In both line and logic a display should be composed as carefully as a picture. Since the Indians had chipped these arrowheads from obsidian, which is as impervious as window glass, I stuck them to the card with a useful cream-rubber cement. This eliminated distracting wires or threads, but rubber cement must be used with caution on porous objects, for it discolors and will produce a stain that cannot be removed. Finally I cemented the card of arrowheads into the bottom of the film box and pressed the window into place over it, completing the job.

I have written of arrowheads, but the reader's mind no doubt will turn to the shells, or whatever he may collect, adapting my procedure to his own needs and tastes. If, for example, he collects butterflies or other organic specimens, he will wish to seal his boxes with some sort of tape to keep destructive insects out. For very small objects he may seek smaller boxes — say 4 x 5 — and if he does not use the film that comes in them himself he will have to scurry around among photographers and beg for empty boxes. Photographers are hobbyists too; they are usually glad to help a kindred spirit — especially when they can do so by giving him a thing they would throw away.

And those little boxes — why, they make it easy to rid our hobby-riding of its helter-skelter tendencies, and they do it practically "for free!"

Staghorn Sumac, Bird Favorite

By MARGARET GROSS GRIEBE

Do we in the eastern half of the United States fully appreciate our native staghorn sumac, *Rhus typhina*, as an attraction for birds? Having planted one of these sumacs outside our west window, we consider it invaluable. This specimen decided to grow into a tree, rare in southern Michigan.

Besides being palatable to many birds, the fruit stays on all winter, or longer. Thus it serves winter and early returning birds. Robins and bluebirds live almost entirely on it for several weeks or more.

Catbirds and brown thrashers also like the staghorn, the catbirds seeming to prefer to pick up seeds under the tree, not only in the spring but throughout their stay here. Cardinals, many species of sparrows, and other birds also come to the tree.

This sumac produces seed abundantly. There is so much that it is never all eaten up. Red spires of seeds stick up all over the tree, or just on the crown of smaller specimens. The spires are usually slightly curved, more like cows' horns. The name of "staghorn" comes from the velvety fuzz on the young branches.

In mid-summer, when the fruit first turns a bright red, which gradually darkens, it contrasts strikingly with the bright green leaves, making one think of Christmas.

An unexpected use for these fruit bobs, as they are often called, is for burning in a smoker for smoking bees when opening the hives. Our state bee inspector recommended them for that purpose.

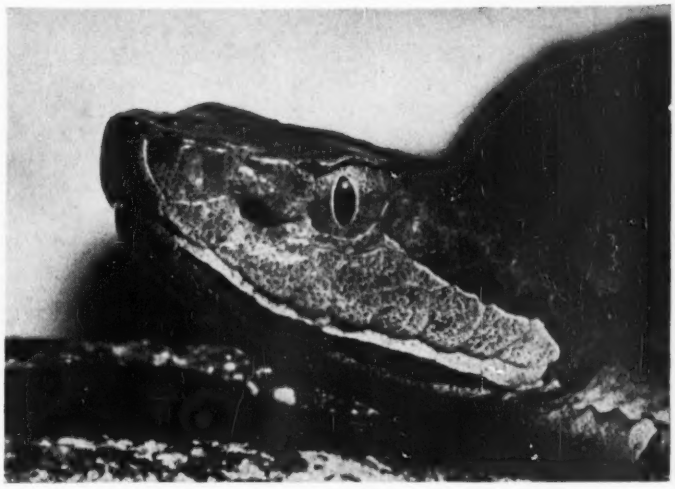
"It doesn't make them angry as some materials do," he said. "In fact, I think it makes them more gentle."

Unfortunately, many people think this sumac is poison. It is not. Both the staghorn and poison sumac have compound leaves, a number of leaflets along a main stem with one at the end, but they are easily distinguishable. The staghorn has many regular teeth along the edge of each leaflet, while the leaf of the poisonous kind is whole with only a few irregularities, and the end leaflet has a stalk. The fruit is very different, that of the poison variety being a waxy white berry, growing scattered on long stems down in the crown of the small tree. It prefers damp or wet localities, while the staghorn grows widely *except* where it is wet.

If you can put up with its habit of spreading, plant some staghorns in your yard and have a magnet to attract the early spring migrants, when food is at a premium. Yes, birds love poison sumac seeds, too!

Unpredictable Copperhead

By LESTER E. HARRIS, JR.



The copperhead is well named for its head is a copper color. The author discovered that all copperheads do not react the same way.

OF all the descriptive terms, unpredictable best fits the copperhead. This deadly poisonous snake with the copper-red head and the chestnut-brown crossbands, variously known as upland moccasin, chunkhead, pilot snake, and poplar leaf, is one of the most unpredictable of all reptiles. By comparison a rattlesnake is a "gentleman." The actions of a "cottonmouth" water moccasin can be anticipated. The little, although deadly, coral snake is a mental and physical sluggard.

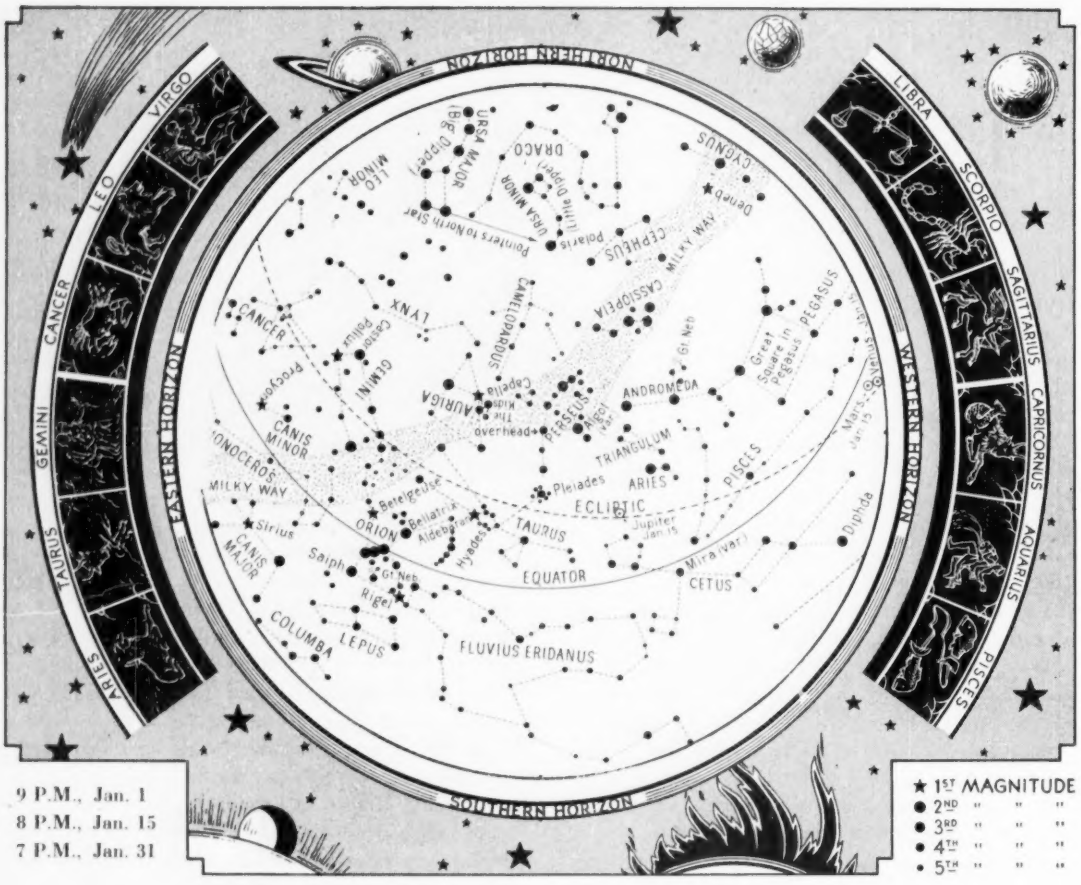
Two personal experiences on two successive days will indicate why I choose the adjective for the copperhead. Both of these experiences occurred during a summer of biological collecting in the Allegheny Mountains in southwest Virginia. My wife and I were staying in an old, one-room log cabin that had once been occupied by settlers. The cabin was located in a wilderness area of a narrow valley through which ran a fast mountain stream. On the opposite side of the stream from the cabin was an open meadow bounded by an ancient stone fence that had long since been reduced to sporadically spaced piles of stone. A distance of several city blocks upstream was another similar rockbound meadow. This meadow came to a V-shaped point, with a mountain rising abruptly up on the one side and the stream running down on the other side.

An eccentric old English lady who owned the place told me about some wild plum trees on the edge of the meadow next to the mountain. She said the trees were loaded with plums, but she was afraid to pick them for fear of snakes in the tall grass and weeds around the trees. I volunteered to mow the weeds with a scythe that very day, since we were caught up with our pressing and cataloging of botanical and zoological specimens collected the previous day.

I picked up the scythe and walked upstream along a path to the upper meadow. Locating one of the fruit trees I made ready to cut the weeds. With the first swing of the scythe, a half-circle of weeds and grass fell down flat. In the next instant I was startled badly, for a small, reddish, copper-colored head literally "popped" up out of the prostrate weeds. A bright red tongue was flicking in and out with great rapidity of motion. The head was raised up on a slender neck for several inches above the ground. The snake peered first this way, then that way, finally fixing its staring, unblinking eyes on me. This copperhead was angry! He was worse than angry, he was fighting mad. I was momentarily transfixed; for the unexpected, particularly where a poisonous snake is concerned, is naturally upsetting.

With one rapid, continuous, fluid motion the copperhead was on top of the weeds and coming toward me, less than four feet away. My first impulse was to run. In the next instant in kaleidoscopic fashion the many conflicting stories I had heard about copperheads ran through my mind. Some have said the copperhead is bold, aggressive, and will attack without any provocation and without first being cornered. Others have said the copperhead is a meek, retiring reptile more interested in escaping as quickly as possible than in attacking. Here was my golden opportunity to find out. I stepped back about four feet. The snake came right toward my legs. I nervously stood my ground. When the snake was about a foot away he paused and drew the rear part of his body up closer and elevated his head all prepared to strike. I stepped back again several steps. Again this venomous fellow came toward me preparing to strike as before. He was mad. I, beyond any doubt, was the object of his ire. The snake and I played this game of retreat and advance for four more times. That was enough. Most of the stories I had heard were true. I was now thoroughly convinced that a copperhead was pugnacious and will deliberately attack a person. It does not have to be cornered to be provoked into such an attack.

I held the scythe in my hands in such a way that the blade was out over the snake. Slowly I brought it down toward him. When the blade was about three inches from his coiled body, I quickly set it down right on his head. He was then picked up by the back of the neck with thumb and forefinger in the best "snake catching" manner. This "copper" was destined for the "pickling" jar of formaldehyde. I had gained an experience and a specimen. (Continued on page 52)



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

The Heavens in 1953

By ISABEL M. LEWIS

THE SUNSPOT minimum will probably be reached in 1953. Around this time there are days when no spots are visible on the face of the sun. The few spots that appear are either spots of the old cycle, which is disappearing in low latitudes of the sun, or spots of the new cycle first appearing in high latitudes. At the minimum the sun is most quiescent. Ultraviolet radiations are weakest, magnetic storms accompanying the appearance of great sunspots are fewest in number, and interference with radio reception least troublesome. The solar corona is now of the sunspot minimum type, with long streamers in the equatorial regions of the sun and short, bushy, rays like magnetic lines of force extending to either side of the sun's magnetic poles. Not until the minimum period of solar activity has passed, and the new cycle is well established, is it possible to fix the time of the occurrence of the sunspot minimum. But it is quite certain that it will be no later than the fall of 1953, or early in 1954.

In 1953 there will be five eclipses — three partial eclipses of the sun and two total eclipses of the moon. In every year there must be at least two eclipses. There may be as many as seven. In the years when only two eclipses are visible they must both be eclipses of the sun. There may be as many as five solar eclipses in a year, but there cannot be more than three total, or annular, eclipses of the sun in a year. If there are three one will occur either early in January or late in December.

The partial solar eclipses of 1953 will occur on February 13-14, July 11, and August 9. The first-named is the largest of the three, with a maximum magnitude of about 76 hundredths of the sun's diameter as seen in Siberia. It will be visible generally in eastern Asia and the western Pacific from Lat. 10 north to the Bering Sea

and Alaska. The eclipse of July 10, E.S.T., will have a maximum magnitude of only two-tenths of the sun's diameter, which is the part covered by the moon at time of greatest eclipse. This will be seen at greatest eclipse in Baffin Land, northeast of Hudson Bay. The eclipse will be visible generally in the extreme eastern part of Alaska, western Canada and the extreme northwestern part of the United States, Hudson Bay and the Arctic regions to the north and northeast over the North Pole, Greenland, except the southern portion, and the Atlantic Ocean north of Iceland and nearly to the coast of Norway. The partial solar eclipse of August 9, the last of the year, will have a maximum magnitude of about 37 hundredths of the sun's diameter visible at a point in the South Pacific. The eclipse will be visible generally in the southern part of Chile and Argentina, Tierra Del Fuego, and southward into the Antarctic regions.

The total lunar eclipse of January 29 will be visible, in part, over all of North America except the extreme northwestern part, and all of South America, and Asia. It will be visible completely in Europe, Africa, the Atlantic Ocean, and Arctic regions. In Eastern Standard Time the moon will enter the shadow of the earth and the partial phase will begin at 4:54 P.M. on January 29. The moon will be completely within the shadow of the earth at 6:05 P.M.; the middle of the eclipse, when the moon will be deepest within the shadow, will be at 6:47 P.M.; and the total phase of the eclipse will end at 7:30 P.M. The moon will leave the shadow of the earth at 8:40 P.M. and the partial phase of the eclipse will end. As some of the early phases of the eclipse will occur before sunset and moonrise, it is evident that the eclipse will not be seen from beginning to end in all of North America, or all of the United States. One must compare his local time of sunset or moonrise with the above times to judge how much of the eclipse, especially its most interesting total phase, he will see. Along the east coast generally the moon will rise partially eclipsed and the farther west one is located the farther advanced will be the eclipse at the time of sunset.

In some of the central or mountain states the moon will rise totally eclipsed; and along the west Coast the partial phase following the total eclipse may be nearly over before the moon rises. In the eastern and central part of the United States, however, as well as in most of South America, the Atlantic Ocean, and Europe, Africa, and much of Asia, the total phase of the eclipse will be observed. The duration of totality from beginning to end will be about 1 hour, 25 minutes. The maximum possible duration of the total phase of a lunar eclipse is about 1 hour, 44 minutes. The moon never disappears from view completely during the total phase; but some totalities are much darker than others, depending upon how much of the light from the earth's atmosphere along the sunrise and sunset zone during the total phase is refracted into the earth's shadow to illuminate the lunar disk with a weird, coppery light. At time of the total phase of a lunar eclipse, which always occurs at full moon, the earth as seen from the moon is in the phase of "new earth," with its night side turned toward the moon and surrounded by its luminous atmospheric ring.

The second lunar eclipse of 1953 will occur on July 26 and will be visible, partially in North America, except the eastern and northeastern parts, in South America, except the eastern part, the Pacific Ocean, Antarctica, Australia, and eastern and central Asia. It will be total, and the moon will be completely within the earth's shadow for 1 hour, 41 minutes.

In the year 1953 there will be a transit of the planet Mercury across the face of the sun. This will occur on November 14, and it may be seen with the aid of a telescope only, because, projected against the sun, Mercury will appear as a black spot no greater in size than a very inconspicuous sunspot. Transits of Mercury are of considerable scientific importance in the theory and calculation of the tables of the motion of Mercury, and these transits, which occur about thirteen times in a century, are always widely observed telescopically by astronomers. They can occur only when the earth is near the points where the orbit of Mercury crosses the earth's orbit, when in conjunction with it. This is possible only within three days of May 8, or five days of November 11; so transits when they occur are within these periods, with November transits twice as frequent as those that occur in May. The coming transit will be in fine position for observation all over the United States, as well as most of North America, and in South America. The last transit of Mercury occurred on November 11, 1940. There will be a May transit in 1957.

In 1953 Mercury, which journeys around the sun more times in a year than the other planets because of its nearness to it, will start the year in the morning sky, but too near the horizon to be seen in the morning twilight. It will pass to the evening sky after superior conjunction with the sun on February 2. Its most favorable position for observation (Continued on page 52)

My Stars

By RAY ROMINE

Since I cannot woo sleep, I sit outside,
My deck chair in the center of the lawn,
And revel in the glory houses hide:
The heavens we ignore from dusk to dawn.
There's Vega's bright blue stare; the dragon's eyes
Return it wink for wink, while Hercules
Above them both stands guarding all the skies,
And Cygnus wings his southward way with ease
To join the eagle. Now the Scorpion's heart,
Antares, flashes redly farther south —
Until Bootes plays his lusty part,
Escorting me in fancy past the mouth
Of Serpens to a dream-date I must keep —
And grateful for the while I couldn't sleep!

The School Page

By E. LAURENCE PALMER

Professor Emeritus of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

FRESH-WATER ALGAE IN SCHOOL

IT WOULD be as foolish to estimate the number of school rooms in which fresh-water algae are available for first-hand study as it would be to assume that there is any substantial school system where no fresh-water algae are available for study inside some room. Any schoolroom where an attempt has been made to maintain an aquarium has been faced with the problem of keeping the development of fresh-water algae within control. In fact, one of the reasons why so many teachers are discouraged from establishing aquaria is that the algae that develop spontaneously often get out of control. One of the problems in maintaining such aquaria is to attain the balance between the development of the algae and of the organisms that normally keep them under control. Really, one should say the organisms and the physical conditions that keep them under control.

The special insert in this issue of *Nature Magazine* gives suggestions as to the nature of our commoner fresh-water algae. It suggests that they are so varied that it is difficult to find fresh water in which some may not maintain themselves. If you have attempted to keep an aquarium you have found that, sooner or later, it may be filled with dirty green water, so crowded with green filaments or green scums that even though fish and water insects may continue to exist the whole mess is too unsightly to be popular in a neat school room. The insert tells you that copper sulphate, or blue vitriol, is commonly used to keep algae from developing in swimming pools and lakes. We cannot recommend the use of this material in the average classroom because it produces an attractive blue liquid that is too poisonous to be left where children might be tempted to taste it.

There are easier ways to control the algae, however, and some of these are suggested in the insert. We told you there that some algae were remarkable because of their ability to continue developing at great depths in the water where little light could penetrate. Since light is a factor in the development of algae, and since the presence of light may easily be controlled, this suggests a simple solution to our problem. If your aquarium is placed in a south window, where the light is strong, try placing it in a north window, where the light is weak, or, better yet, place one aquarium where the light is strong and a similar one where it is weak. Then let the children decide, from what they see, how they think the problem might be solved.

If you have come to agreement that light can be used to control the abundance of algae in a school aquarium, then try as many different ways as you can think of to prove the point. Make a black paper cover for your aquarium, and when the algae get too abundant cover the aquarium for a few days with this light shutter and see what happens. I have found that it is usually adequate, for an aquarium in a north window, to exclude light from only the exposed side of the aquarium. This may be done by pasting a sheet of black paper on the outside of the aquarium towards the window, leaving the opposite side free for your observations. It is even better if, instead of using a sheet of black paper, you cut a piece of mirror large enough to cover the window side of the aquarium and fasten it permanently there so that you may look into the mirror through the aquarium from the open side. This has the double advantage not only of cutting off the extra light but of, apparently, doubling the depth of your aquarium and doubling the number of plants and animals in the aquarium.

There are plenty of more complicated things you may do with fresh-water aquaria and the algae that are to be found within them. High school teachers will find it worth while to try to maintain small fruit jar aquaria in which the kind of algae supported are limited as to species. A jar of spirogyra, one of cladophora, another of zygnema, and still another of ulothrix provide fresh material for laboratory use. It is easier, however, to say that this may be done than it is to get it done. A pure culture of algae requires attention if you wish to get it established, and more attention if you wish to maintain it.

Start a series of vial aquaria with distilled water in them and keep the tops plugged with cotton. When you have some fresh spirogyra wash it as free of other materials as possible in running water, then put a small piece in one of your vials. Do the same with other algae in other bottles. You may get no results that are to your liking with the distilled water. Then try using tap water, or other water that you think is reasonably free of undesired algae. Eventually you may, with luck, get a reasonably clear culture that will maintain itself if you do not expect too much of it.

Do not expect a summer annual alga to be at its best at Christmas time in your aquaria. Do not expect your algae to develop the desired reproductive stages at times of year when this is too abnormal. Try inducing your algae to produce these by changing the temperature; by permitting some of the water to evaporate, thus increasing the concentration of salts in the water; by keeping the algae in darkness for some days and then exposing them to strong light; by allowing the algae in a small aquarium to develop to such a point that the water can obviously permit no further increase in the growth of the algae. Determine for yourself which, if any, of these factors may have any effect on the algae with which you may be working. Let a fruit jar aquarium with algae become totally dry. Add water and see whether your algae can recover from dessication.

It should be obvious from the insert, and probably from your field experience with algae, that different algae reach their maximum development in different kinds of environment. If you get some *chara* established in your aquarium, change the acidity of the water and note the effect on the growth of the plants. If you have jar aquaria, maintaining with reasonable success different algae that you have identified, add a few drops of vinegar, or other acid, to the jars at intervals of a day to see if this affects the prosperity of your algae uniformly.

If you have been able to come to some conclusions about the preferences of your algae, then try to find out if the enemies of algae have any specific preferences. Goldfish will feed on algae. If given the chance to feed on one kind in one end of an aquarium, and in another at the opposite end, do they show any preference? How does this hold with other fish and with insects that feed on algae?

Sometime you might like to try eating a few fresh-water algae yourself. I have done it for the fun of it. If you try it be careful about where you collect your material. Algae collected from a small, remote pond from whose drainage domestic animals have been excluded should be reasonably safe, while one should naturally avoid algae grown in ponds that might be polluted with the discharges of domestic animals.

Let the children make regional maps of the areas where they have found examples of the algae listed in our insert, or elsewhere. Let them make lists or notes on the algae found in a stream above and below your community. Try growing algae and other aquatic organisms in water collected above your town and downstream from your town, below where sewage may be dumped. Let them draw their own conclusions. Do not do this for them, for your own protection from the wrath of some narrow-minded city father. Let the children make charts dealing with the role of algae in the food resources of your community, in the beauty of your community, its health and its general economy. Let them make similar reports on the seasonal changes that take place with local algae, and if you can find any evidence of the relationship of algae with soil erosion, and with soil building, get the idea

over to the pupils. DO NOT let your study of algae in the classroom limit itself to the indentification of a few genera, or to the preparation of a few poor drawings of the morphology of a few kinds of freshwater algae. You will find this study wholly worth while, interesting and revealing if you approach it with an open mind.

Research

An Introduction to Scientific Research. By E. Bright Wilson. New York. 1952. McGraw-Hill Book Company. 375 pages. $6.00.

This text is directed toward graduate students or others entering upon a research career in any branch of science. It is thus a practical guide, providing some general advice, but, in the main, giving highly concrete but widely applicable information.

Elephants

Komoon! Capturing the Chad Elephant. By Heinrich Oberjohann. New York. 1952. Pantheon Books. 219 pages. Illustrated. $3.00.

The author of this book is a big game catcher but not a hunter. He has shared the life of wild elephants in the Lake Chad region of central Africa, and has studied the way of life of these great animals. This is the story of his experiences, and they are exciting, informative, sometimes heartbreaking.

Story of Weather

Wind, Storm and Rain. By Denning Miller. New York. 1952. Coward-McCann. 177 pages. Illustrated, with end piedes of weather signs. $3.95.

This popular discussion of weather, and what causes it, is not intended to make everyone his own weather prognosticator but to, at least, give the reader some idea of the forces that operate to bring about wind, storm and rain. The author, son of the late Alice Duer Miller, was an air navigator during World War II, and the author of basic manuals for naval air training. After reading this book weather maps become meaningful and one is tempted to see how well one can function as an amateur meteorologist.

Plant Systematics

Systematics of Flowering Plants. By Patricia Mann. New York. 1952. Pitman Publishing Corporation. 307 pages. Illustrated. $4.50.

This introduction to flowering plant systematics first discusses the history of systematics and nomenclature, then deals with the various principles involved. There is then demonstration of the application of these principles to twelve families of plants, an illustrated glossary of the morphological terms used, and, finally, practical instructions for floral dissections and the construction of floral diagrams.

Grasslands

Grasses and Grassland Farming. By Hi W. Staten, with a foreword by Louis Bromfield. New York. 1952. The Devin-Adair Company. 319 pages. Illustrated. $5.00.

In this book the author, who is Professor of Agronomy at Oklahoma A. & M. College, shows how half the United States can produce year-around green pastures, and how the other half can increase its grazing season by two to four months. The book also shows the individual farmer that he can increase his livestock profits greatly if he knows what grasses and legumes he really has and develops them properly. This a practical book on grassland management.

Pacific Tides

Between Pacific Tides. By Edward F. Ricketts and Jack Calvin. A third edition, revised by Joel Hedgpeth, with a foreword by John Steinbeck. Stanford, California. 1952. Stanford University Press. 502 pages. Illustrated. $6.00.

This book, first published in 1939, has become a classic work in the field of marine biology. In it revision, Dr. Hedgpeth of the Scripps Institution of Oceanography has preserved the warmth and spirit of the original text and incorporated new material discovered as a result of wartime research. This is the story of and introduction to the fascinating and varied life found in the tide pools and along the rocky shores of the Pacific Coast, one of the most prolific life zones in the world.

Briefly Noted

Marine Fouling and Its Prevention. Prepared for the Bureau of Ships, Navy Department, by the Woods Hole Oceanographic Institution. Annapolis, Maryland. 1952. United States Naval Institute. 388 pages. Illustrated. $10.00. The latest and most authoritative information on a subject of great economic importance.

Harwell. New York. 1952. Philosophical Library. 128 pages. $3.75. A report of the work of the British Atomic Energy Research Establishment from 1946 to 1951.

Development of the Guided Missile. By Kenneth W. Gatland. New York. 1952. Philosophical Library. 133 pages. $3.75. The story of how far we have come in the development of this weapon of war.

The Outdoor Trail of Don Stillman. By Don Stillman. Harrisburg, Pa. 1952. The Stackpole Company. 182 pages. $3.00. Selected writings of the late outdoor writer of the *New York Herald-Tribune.*

A.B.C. of Cat Diseases. By P.M. Soderberg. Fond Du Lac, Wisconsin. 1952. All-Pets Books. 64 pages. Illustrated by Lynn Hamilton. $.85. Authoritative information on how to keep one's cat healthy or restore it to health.

Evolution and Human Destiny. By Fred Kohler. New York. 1952. Philosophical Library. 120 pages. $2.75. The evolution of life is shown as the continuation of an "evolution of chemical complexity which must necessarily have preceded the existence of the most primitive living forms."

Future Forests

Forests for the Future. As Told in the Diaries and Papers of David T. Mason. Edited by Rodney C. Loehr. St. Paul, Minn. 1952. Forest Products History Foundation of the Minnesota Historical Society. 283 pages. $3.50.

During a lifetime as a forester, David T. Mason kept careful diaries and this volume is based upon them. Here is a picture of forestry and our handling of our forests during the past nearly fifty years. Here also is the background for our attitude toward the forests of tomorrow. This is a valuable contribution to forest history, and to conservation history.

Tropical Forests

The Tropical Rain Forest. By P.W. Richards. Cambridge, England. 1952. Cambridge University Press. 450 pages. Illustrated. $12.50.

This is an ecological study of the tropical rain forests, which include about one half of the world's forested areas. Until the last hundred years man has been relatively little concerned about these forests and his impact on them had not been great. The past century, however, has seen great inroads into these areas, for cultivation and for the exploitation of rain forest resources. Such forests could be wiped out, at great economic and biological loss to mankind. This splendid book presents the story of the rain forests, and what they mean.

Australian Bush

Flying Fox and Drifting Sand. By Francis Ratcliffe. New York. 1952. Anglobooks. 332 pages. Illustrated. $4.25.

This is a record of vagabondage in the Australian bush; a record of the places and people seen, the creatures and the problems of life in this area. It includes a study of the giant fruit-eating bats, known as flying foxes, and a fascinating word picture of the Australian inland.

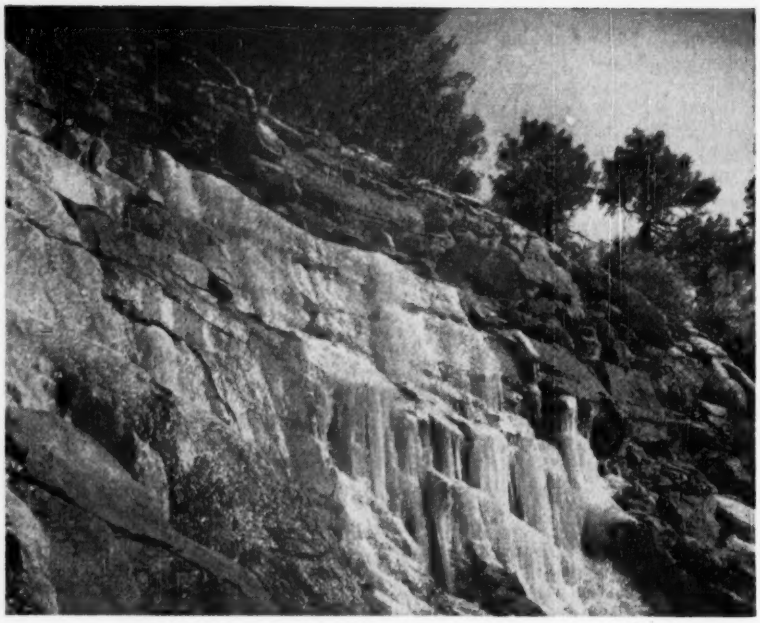
Australian Animals

Furred Animals of Australia. By Ellis Troughton. New York. 1952. Anglobooks. 376 pages. Illustrated by 25 plates in color by Neville W. Cayley. $6.00.

Australia's fauna is varied, fascinating and quite well publicized, as might be expected for a country that boasts the platypus, the koala and the kangaroo. Here is a popular guide to Australian mammals that has run through four editions and is now brought out in a 1952 American edition. It makes one want to visit the great island continent right away.

Camera Trails

By
EDNA HOFFMAN EVANS



Frozen waterfall. Shots like this are possible during winter months when seepage from rock cliffs and embankments freeze into interesting icicle patterns.

AWAY back when I was a kid in junior high school I had to read a poem by Henry Wadsworth Longfellow called "The Arrow and the Song." Not only did I have to read it, I also had to memorize it. I can quote it even now:

"I shot an arrow into the air,
It fell to earth, I knew not where..."

There was some more to it about the poet's eyesight not being keen enough to follow the arrow's flight, and so he lost his arrow. Then he went on to say almost the same thing about breathing a song into the air, too. He concluded the poem by telling how years later he found the arrow in the heart of an oak, "still unbroke," while the song "from beginning to end," he "found again in the heart of a friend."

In junior high days that poem did not mean very much to me. I was an amateur archery enthusiast at the time and I thought the poet was mighty careless with his arrows. As for his point about the song — I did not understand that at all.

Now, however, the poem means a lot more to me. I think of it often when I write "Camera Trails" and I wonder where my verbal arrows will go. When I get letters from readers, I know where some of them have gone, and I know what impression (good or bad) they have made.

For example, not so long ago I received an interesting letter from a reader in Houston, Texas. He got a lot of things off his chest in that letter — things that other readers may have wanted to say, too. This is what he wrote:

"Several months ago your camera page had a very interesting article about using the enlarger. With the article were two pictures, one a street scene in some Latin American city and the other a portion of the original enlarged. Although I enjoyed your article very much, I still did not see anything too wrong with the original picture. Of course there were blurs where people were moving, but doesn't that give a lifelike look to a picture of a street? At least it showed the picture over a fairly large area, whereas the picture of the woman showed just her.

"The enlarger is fine for anyone who has the time, inclination, ability, and a place to keep the enlargements and the enlarger after he has done an evening's work making pictures. For the average person who takes pictures on week-ends or vacation trips and is not too serious about it, I would say that the enlarger is too much trouble. Naturally, if a person is inclined to use gadgets, he would like enlargers.

"The photographers, camera makers, or somebody has talked up the enlarger business until everybody who buys a box camera thinks that he also has to buy an enlarger. Then he has to have space to store the brute, along with three developing pans, various bottles of chemicals, ferrotypes, red lamps, and heaven only knows what else. If the poor wretch who owns the contraption is a man, his good wife will eternally be after him to put it away or do something with it. Also, she will want to know where those stains came from.

"I know very little about photography but love to take pictures. It was a long time before I ever found out anything about f stops and shutter speeds, so then I bought an exposure meter. I still do not take good pictures from a photographer's view point, but I do better than I did before I found out about f stops. You know that most of us who take pictures are not much beyond the point and snap stage.

"The enlarger enthusiasm overtook me as it has a great many folks. I bought a good one and tried my hand, but after a few months I decided that the thing was more trouble than it was worth. It would keep me up until midnight, then I would have to clean up the kitchen, put the prints on the ferrotype sheets, and get things straightened up so we could have breakfast next morning. While doing this I would awaken everyone in the house and then go to bed tired. Next morning I would find that most of my prints were too light or too dark. For my part, the professionals can have it because they can make prints a lot cheaper than I can.

"I paid more for that enlarger than I did for my 35mm camera. It would have been better to have added that money to my camera; then I could have bought a really good camera. I have just recently traded the enlarger in on a new Bolsey C 35mm that has both reflex and mechanical finder. My other cameras consist of an old 116 Kodak with an f 7.7 lens, an old German 6 x 9cm film pack f 4.5, and a just recently acquired old time post card size Kodak with an f 6.3 B & L lens that takes wonderful pictures.

"The enlarger caused me to buy the old post card sized Kodak for I got tired of fooling with the enlarger. Now why did they quit making that fine old camera? Does everyone acturally want to take stamp sized pictures, or have people just been pushed into it? You cannot even buy the old 116 size any more. With today's light metals, a post card camera with a 4.5 or a 5.6 lens, body shutter release, eye level view finder, plus any other improvements, would enable a person to come home with a set of pictures he could see. A post card contact print costs a nickle, while the jumbo prints and enlarged 35mm pictures cost seven cents each.

"For my part, I will take a 35mm for color and a camera for black-and-white anywhere from size 116 up to 4 x 5 and let the folks who like enlarging have it. I do not average more than three or four rolls of film a month so the enlarger is not worth it. Anyhow, where would I keep all those 5 x 7's and 8 x 10's?"

I thought that was a pretty good letter. Those Texans have a way of getting things said — and done. This is the way I answered it:

"I got a big bang out of your letter. I can say that I honestly agree with almost every word of it. On the other hand, I can also turn around and give you an argument from the other side. That is one of the many things I like about photog-

Whenever possible it is well to "frame" distance shots with foliage that is closer to the camera.

raphy — there are so many different points of view possible, both figuratively and literally.

"To answer your letter a paragraph at a time:

"So far as the Mexican pictures were concerned, I happen to like 'still' pictures to be still. Blurs of movement bother me and I tend to classify as unusable negatives that do show movement. However, by cropping, unblurred parts can sometimes be salvaged. No commercial photofinisher would take the time to do that. Thus, a self-operated enlarger is the only answer in that particular instance.

"An enlarger for a casual snapshooter is just so much excess paraphernalia: I heartily agree. For that matter, an enlarger for anybody who cannot arrange for a permanent darkroom set-up is a darned nuisance. Until I had access to such a set-up, I did not try to do much darkrooming. I hate to put things away, too, and I usually manage to drag out a carload of stuff, regardless of whether I am taking or printing a picture. On the other hand, I remember some very pleasant evenings spent in a friend's kitchen in Houston in the winter of '47, enlarging and developing pictures. As I recall it, he kept his enlarger on a closet shelf when it was not in use, and his wife did a lot of fussing at him, too. The three of us had fun, though, and the cleaning up did not take so long when we all pitched in and did it.

"The professional photofinisher can do a good job, but I will not say he can do a better job than the guy he is printing pictures for. After all, when the guy knows what he wants, the photofinisher is not always psychic enough to understand. Anyhow, you just see the finished work. The professional manages to spoil a lot of paper, too.

"So far as camera size is concerned, the big ones are better. Or rather, the big ones give pictures that are big enough as-is. You do not have to get them enlarged or develop a pair of microscope eyes in order to see the results. I dunno about modern light metals making lighter post card sized cameras possible. You would still have bulk, even if the weight were cut down. Personally, I think the small size of the 35mm camera is definitely misleading. I carried my 4 x 5 Graflex a good many weary miles before investing in a miniature camera. But, pshaw, by the time I shoulder the gadget bag loaded with flash gun and bulbs, filters, extension tubes, light meter, extra film, and a few other odds and ends, I might just as well carry the Graflex. I usually end by carrying them both. Some job!

"But far be it from me to drive you into the darkroom, or suggest that you mess up the kitchen with developer, hypo, and such stuff. For those who like it, it is fine. For those who do not — fine also. As for me, I can take it, or let it alone."

In his reply to my letter, my Houston friend added some enlarger information that may be of interest and assistance to other 35mm users. He wrote:

"I still have an enlarger of sorts. It looks like a shoe box, is fixed focus, and enlarges 35mm negatives to 3½ x 5 and, if the negatives are normal, it is surprising what it will do. You cannot do any tricks like dodging or cropping with it, but for straight run pictures it does very well. I believe a skillful and patient person could really do good work with it. This little fixed focus enlarger is made by the Agawam Products Company. I believe it will do pretty well for anyone who takes an occasional roll of black-and-white 35mm. At least it allows the photographer

to see what he got without too much expense, and he can then have the professionals work on the good ones."

As you can see, there is more than one side to the enlarger situation.

I have received two other letters recently on the matter of Kine-Exakta close-up focusing. One came from New Jersey and the other from California. Obviously, Exakta enthusiasts are to be found from coast to coast.

Both writers inform me of the 2-in-1 adapter, made by Ihagee, which will overcome the 22-inch gap I mentioned in connection with close-up focusing with and without extension tubes. This adapter functions in the same manner as extension tubes, but gives an extremely short extension (just 5mm). Thus, it will bridge the focusing difference between that given by the shortest extension tube, and no extension at all.

And so the verbal arrows I shoot travel in many different directions and reach many different marks. It is interesting, and at the same time it is a little awe-inspiring, too. Needless to say, I hope my verbal arrows will carry messages that are interesting, entertaining, informative, and helpful to the people who read then — throughout the coming year.

In closing this January section, I want to wish for all Camera Trailsmen a happy, successful, photographic 1953.

THE CASE OF THE COUGAR

(Continued from page 12)

writes in *The National Geographic*: "...today the cougar's big game kill probably doesn't amount to more than one or, rarely, two deer a month."

We have heard plenty from the two-weeks-a-year hunter and the urban outdoorsman. Their ideas of game management have proved to be as narrow as their ignorance of its problems is wide. We have also heard from those who profit by the pernicious bounty system. At the cougar's retrial let us listen to experienced biologists, ecologists, naturalists and wildlife management experts. These are strong and hard-to-beat witnesses in the cougar's defense, and they should be given a day in court before final sentence is passed upon our great native American cat.

The world's greatest predator, man, is already responsible for the extinction or near-extinction of more than forty species of animals and birds on the North American continent. Let us be a little more sure of the wisdom of what we are doing before we are stampeded into digging the cougar's grave and burying him alongside the passenger pigeon, the kit fox, the Carolina paroquet and the Atlantic right whale.

SKYLARKS ABROAD

(Continued from page 17)

the members of the Pacific Bird and Mammal Society to this field to see and hear the skylarks. The birds performed nobly. Singing birds were all around and above us, soaring and circling, "dropping from on high the joyous torrent of their song" as if aware of an appreciative audience. From Washington State a high school teacher had brought a class of boys, especially to see and hear the skylarks, and there was keen disappointment when no nest could be found. But two of us lingered at the field, just in hopes. Then it happened! We saw a skylark flutter close to the ground and drop. Hurrying to the spot, watching our steps, we flushed the bird, and there at our feet was a nest. In it were three gray-green, earth-spotted eggs. So deep were the eggs below the surface it is possible that had one, unknowing, stepped on the nest, no harm would have come to the eggs, but later the young overflowed the sides and a step would have crushed them. Of course, everyone came trooping back to see, and the expedition had a perfect ending.

The skylarks sing most of the year. During the raising of two or more broods, the male sings throughout the daylight hours, then, family duties ended, he rests a while. In August he sings again, but with a less spectacular outpouring. During cold winter days, he is silent save on a warm sunny day. Then, as one writer puts it: "The Lark drops from on high onto the field still all white the joyful torrent of his song," and brings to listeners courage and cheer. Wordsworth said the skylark was blessed "with a soul as strong as a mighty river," while Tennyson was most moved by the skylarks' miracle of song while watching them on a day of summer showers. He makes their song and flight move in and out of a word picture of unusual beauty in his poem "The Skylark":

How the blythe lark runs up the golden stair
That leans through cloudy gates from Heaven to earth,
And all alone in the empyreal air
Fills it with jubilant, sweet songs of mirth.
How far he seems, how far
With light upon his wings!
Is it a bird or star
That shines and sings?

And now he dives into the rainbow's rivers;
In streams of gold and purple he is drowned;
Shrilly the arrows of his song he shivers,
As though the stormy drops were turned to sound;
And now he issues through —
He scales a cloudy tower.
Faintly, like the falling dew,
His fast notes shower.

A watcher will see a skylark take flight, rise higher and higher, singing and circling, flutter, then soar, often until out of sight, for maybe twenty minutes or longer. Suddenly the song will cease, and the bird literally tumbles toward the earth, only levelling off in effortless flight when the ground is a bare wing-beat beneath it! These sudden bursts of melody and sudden silences are worded vividly by a modern writer, Lizette W. Reese of Salisbury, England:

A close gray sky
And poplars gray and high
The countryside along;
The steeple bold
Across the acres old —
And then a song!

Oh, far, far, far,
As any spire or star
Beyond the cloistered wall!
Oh, high, high, high,
A heart-throb in the sky —
Then not at all!

But perhaps it remained for the Canadian, McRae, to pen the words dearest to the heart of the western world,

In Flanders fields the poppies blow
Between the crosses row on row
That mark our place
And in the sky
The Larks, still bravely singing, fly
Scarce heard amidst the guns below.

And in Victoria the descendants of brave and hardy immigrant skylarks have brought nothing but joy to the land of their adoption, and will continue to thrill Nature lovers as long as there is an open stretch of sun-drenched, wind-swept field where they can soar and sing above, while their gray-brown mates sit close to the gray-brown soil.

Crater Lake Birds

The Birds of Crater Lake National Park. By Donald S. Farner. Lawarence, Kansas. 1952. University of Kansas Press. 187 pages. Paper-bound, $1.25.

The author of this book has served frequently as a temporary naturalist under George Ruhle at Crater Lake National Park, devoting much time to study of the bird life there. From his field work and extensive notes he has prepared what is primarily an inventory of this park's avifauna. The author first discusses the Crater Lake area, its geology and history and other factors involved with its bird life. The balance of the book is an annotated list of the birds.

ANSWERS TO BIBLICAL ZOO QUIZ

1. bear; 2. lion; 3. wolves; 4. foxes; 5. camels; 6. roe; 7. apes; 8. goats; 9. conies; 10. leopard; 11. asp; 12. viper; 13. dromedaries; 14. stork; 15. owl; 16. vultures; 17. pelican; 18. peacocks; 19. adder; 20. ravens.

Little Gardens

Picture Primer of Dooryard Gardening. By Margaret O. Goldsmith. Boston. 1952. Houghton Mifflin Co. 48 pages and end papers. Illustrated by Else Bostelmann and John Burton Brimer. $2.00.

This is a practical, colorful and suggestion-packed guide to dooryard gardening, the treatment of plantings close to the house, or in the kitchen garden. It would seem to answer about every question that might arise as to how to treat this plot or that corner close to the home building.

Fun in the Water

Fun in the Water. By Commander Bob Winston. New York. 1952. June, Osborn, Foster and Smith. 62 pages. Illustrated by Eric Gurney. $1.00.

This is an entertaining and instructive guide to full enjoyment of the water, both swimming on its surface and poking about in the underwater wonderland.

Japan's Parks

The National Parks Portfolio of Japan. 1952. The National Parks Association of Japan, Ministry of Health and Welfare. 180 pages. Illustrated. $5.00.

This is a lovely collection of photographs of scenes in the seventeen national parks set aside in Japan. Captions for the pictures, and more complete description of the subjects printed in the back, are in both Japanese and English. A National Parks Law was promulgated in Japan in 1931 and has added a new page to the country's cultural history. This book is a beautifully printed and effective record of what has been accomplished during the past two decades.

Products

Fold-A-Tray is a neat, nicely made little tray that fits permanently on the inside of the dooor of any automobile and is equipped to hold a cup of beverage and a sandwich or such. Available from Maryland Mail Order, Box 605, West Hyattsville, Maryland $1.98 . . . Neg-A-Lith is a new type, quality, low-cost film for offset work developed by Michael Lith Company, 145 West 45th Street, New York 36, N.Y. . .Indoor plants can be given a permanent luster and be dust-resistant with Instant Plant Shine, a new liquid plant beautifier developed by Schultz Company, 2028 Washington, St. Louis 3, Mo. . . Fermex is the name that The Fermex Company, 11 Hill St., Newark 2, N.J., has given to a new product that prevents clogging of septic tanks by the liquefication of organic wastes. . .Continental Hardware Co., 539 Overbrook, S.E., Grand Rapids 7, Michigan, produces the "Robemaster," a chrome-plated double clothes hook that slips into a patented slot slide. Costs sixty-nine cents.

Bulletins

"Vitamins in Current Clinical Practice," available from Lederle Laboratories, 30 Rockfeller Plaza, New York 20, N.Y., is an up-to-date, popular discussion of what we know of vitamins. . ."Our National Forests" is Agriculture Information Bulletin No. 49, available for 20 cents from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. . ."Agatized Rainbows" is a colorful booklet brought out by the Petrified Forest Museum Association, Holbrook, Arizona, at thirty cents. . . "Cyclamen Persicum, Its Natural and Cultivated Forms" by Walter C. Blasdale is published by Stanford University Press, Stanford, California. . ."The Mesquite Problem on Southern Arizona Ranges," by Kenneth W. Parker and S. Clark Martin is Circular 908, U.S. Department of Agriculture, and available for 25 cents from the Superintendent of Documents, U.S. Government Printing Office, Washington 25. D.C. . ."Preservative Treatment of Fence Posts and Farm Timbers" by J. Oscar Blew, Jr., and Francis J. Champion is Farmers' Bulletin No. 2049, U.S. Department of Agriculture. . .Recent bulletins from the Smithsonian Institution, Washington, D.C. include "The Mechanics of Snakes" by Alfred Leutscher; "Hormones and the Metamorphosis of Insects by V.B. Wigglesworth; "The Fauna of America" by Austin H. Clark.

Park Visitors

During the travel year ending September 30, 1952, there were 41,516,664 visitors to areas under the administration of the National Park Service. This figure almost doubles that for 1941, and adds a terrific burden in providing facilities for the visiting public and in protecting the areas from the destructive results of overuse. Most heavily visited area was the Blue Ridge Parkway, which links Shenandoah National Park with Great Smoky Mountains National Park. Of the western parks, Rocky Mountain and Yellowstone were the most visited, with 1,338,511 and 1,330,387 visitors respectively. There were 1,799,876 visitors to the Lincoln Memorial in Washington, D.C.

Jays Play Marbles

From Hollywood, California, Gladys Haggerty writes that, recovering from illness, she had been playing Chinese checkers in the yard. Leaving the marbles on the board at lunch time, she returned to find half of them gone. Finally it was found that the blue-jays fancied them. Then followed a time of testing the birds' interest by tossing marbles on the ground. Gradually the jays came closer, taking the marbles away. When, apparently, their nests held too many marbles the birds started to bury them. They seemed more interested in playing marbles than in food.

THE HEAVENS IN 1953

(Continued from page 45)

in the evening sky in 1953 will be around the time of its greatest eastern elongation on March 2. The best time for observing Mercury in the morning sky will be around the time of greatest western elongation of August 13. Other dates of greatest eastern elongations, around which it will be observable in the evening sky, are June 27 and October 23. Mercury will be found visible in the morning sky around the dates of April 15 and December 1, as well as August 13. Superior conjunctions with the sun, additional to that of February 2, will occur on May 24 and September 7, and inferior conjunctions with the sun will occur on March 18, July 25, and at transit of the planet across the sun on November 14.

Venus, at the beginning of 1953, is a magnificent evening star, high in the western sky at sunset. It will reach its greatest distance east of the sun, and be highest in the western evening sky, on January 31. Greatest brilliancy will be attained on March 7, and Venus will pass to the morning sky after inferior conjunction with the sun on April 13. Venus will be at greatest brilliancy in the morning sky on May 19, and at greatest western elongation and highest in the eastern sky at sunrise on June 22. It will remain visible in the morning sky for the rest of 1953.

Mars is low in the southwest at sunset at the beginning of the year. It is now no brighter than a star of 1st magnitude. It starts the year in Aquarius and passes into Pisces late in January. On July 8 it will be in conjunction with the sun, and will then pass into the morning sky, where it will be for the remainder of the year. On July 25 Mars will be farthest from the earth, at a distance of 245 million miles, when its brightness is no more than that of a star of 3rd magnitude. This is not a favorable year for observing Mars. It will end the year in Libra, well up in the morning sky at sunrise.

Jupiter, on January 1, is east of the meridian at sunset in Aries and a brilliant object. It will be on the meridian about sunset on Feb. 1. It will remain in the western evening sky until conjunction with the sun on May 25, when it will pass to the morning sky. It will not be in opposition to the sun until December 13, when it will be visible all night.

Saturn will be found, at the beginning of 1953, in the morning sky in Virgo, a few degrees northeast of Spica. The outer planets move very slowly through the constellations. Saturn, as the most distant of the planets visible without telescopic aid, moves most slowly eastward through the constellations of all the bright planets. It will remain in Virgo until in December, when it will pass into Libra. On January 17 it will be near the meridian at sunrise. It will be in opposition to the sun and visible all night on April 14. On July 13 it will be near the meridian at sunset and will then pass into the western evening sky. On October 23 it will come into conjunction with the sun and pass to the morning sky.

The three outermost planets, Uranus, Neptune, and Pluto — are all telescopic objects, with the occasional exception of Uranus, which is slightly brighter than a star of 6th magnitude when most favorably placed, and can be glimpsed without telescopic aid if one knows just where to look at such times. Neptune is about as bright as a star of 8th magnitude. Pluto is of 15th magnitude. In 1953 Uranus will be in Gemini, not far from the bright star Delta. Neptune will be in Virgo not far from Spica. Pluto will be not far from the star Epsilon Leonis, in The Sickle in Leo.

UNPREDICTABLE COPPERHEAD

(Continued from page 43)

The second experience occurred the next day, just outside the cabin. A sudden thunderstorm ceased almost as quickly as it had started. The sun was out hotter than ever. My wife let "Spunkie," the mongrel pooch, out of the house. Within a few minutes we heard muffled barks close at hand. They sounded so peculiar I went outside to see what was going on. "Spunkie" had run something in an old groundhog hole in the stone fencerow along the creek, a fencerow that was almost hidden by weeds. The dog was alternately digging furiously and poking his head down the hole and barking. I could not see very well because of the weeds so I stepped over closer to get a better viewpoint. My feet were bare except for a pair of slippers that consisted primarily of a sole and two straps. As I stepped into the weeds something "wriggled" under my foot! It felt like a snake! I leaped back, over-cautious as a result of the previous days experience. A copperhead in the immediate vicinity at that moment was as welcome as a bee in the britches. I picked up a stick and parting the weeds searched the ground thoroughly without seeing anything. Deciding my imagination was working overtime I stepped back into the weeds toward the dog. As I did so, a huge copperhead fully forty inches long crawled directly from between my two, nearly bare feet over toward the dog and disappeared into a crevice in the stones! I had actually stepped on this snake! It did not get mad. It did not strike at me. It had simply peacefully crawled out of the way.

The copperhead is certainly unpredictable!

Natural History

The Golden Treasury of Natural History. By Bertha Morris Parker. New York. 1952 Simon and Schuster. 216 pages. Illustrated completely in color. $5.00.

The author of this beautiful book is widely known for her work in science education at the Laboratory School of the University of Chicago. It is the story of Nature from the parade of the ancient animals to a study of the heavens. Pictorially and textually it is a fascinating introduction to natural history, not only for boys and girls but for adults. It is a distinguished addition to the growing number of Nature books being brought out by this publisher.

THE INPERILED KLAMATH — TULE

(Continued from page 36)

Tule can set a dangerous precedent. If the plan is successful, other vitally important waterfowl areas can meet the same fate. And if such actions are carried out far enough, the waterfowl of America can well fly the skyways into the oblivion to which winged the passenger pigeon.

As I left Klamath on a beautiful August morning, I saw, far in the distance, long flights of ducks heading over the mountains from the northwest. For a moment they were silhouetted high in the sky; then they dipped below the horizon for the long downward incline to the refuge. There they will find rest and food in abundance. I could not help hoping and praying that those air-borne creatures and their descendants will find that haven on the Klamath-Tule in the years to comes.

Museum of Natural History

The World of Natural History. By John Richard Saunders. New York. 1952. Sheridan House. 321 pages. Illustrated. $5.00.

This is the story of Nature as revealed in the American Museum of Natural History in New York. Any visit to this great museum cannot fail to leave the visitor unsatisfied — unsatisfied because, however long he is able to spend there, his visit never is long enough. There is so much to see and it is so dramatically displayed that it is a matter of returning again and again. This is all very well for those living in the vicinity, but for one who comes from a distance the problem is different. This book, then, is a visit to the museum by proxy; a description of what is there. In addition, it would be a splendid book to be read by anyone contemplating a visit to the museum as a guide to seeing everything possible within the limits of the time available.

Microbiology

Soil Microbiology. By Selman A. Waksman. New York. 1952. John Wiley and Sons. 356 pages. $6.00.

This is a book devoted to the life in the soil that produces our cultivated and wild plants. In covers the biological, physical and chemical processes that go on continuously in the soil and in which microbes are involved. It is a textbook and its author is Professor of Microbiology at Rutgers University.

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UNDER THE MICROSCOPE

By JULIAN D. CORRINGTON

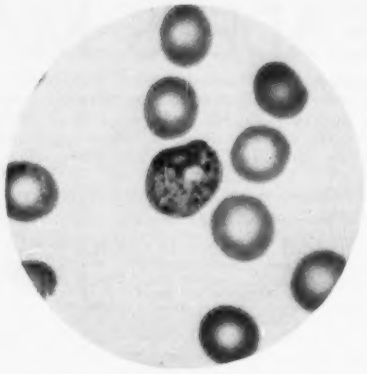
MALARIA

MOST people once thought that night air, and particularly that from marshy regions, was dangerous in that it conveyed disease in some mysterious manner. Many of the uneducated still think so today. *Miasma*, from the Greek verb, to pollute, is a term indicating infectious particles or germs floating in the atmosphere, or the polluted air itself, and we expect a miasmatic vapor to be distilled by Poe's dank tarn of Auber, or his misty mid-region of Weir. Breathe the *mala aria* (Italian, bad air), and you became ill, it was said. Hence, through the middle ages and until relatively recently, Europeans and early Americans kept their windows tightly closed at night and slept in rooms made still more hermetic by heavy curtains and even bed draperies. Small wonder that tuberculosis flourished.

Up to the year 1880, indeed, malaria, deadliest of all killers of man, was supposed to be caused by "poisonous vapors" from marshy regions. Changes in the blood and connective tissues had been noted — a darkening of the cells — but that was all doctors knew about any presumed cause of this disease. Then, in 1880, Alphonse Laveran (1845-1922), French army surgeon, made a basic discovery while working on the blood of malarial patients in Algeria. The darkening, he found, was due to pigment, and the producer was a protozoan parasite inside the red corpuscle. Laveran worked out the detailed structure of this minute animal, and named one of the several kinds, *Plasmodium malariae*.

While knowledge of the pathogen or cause of malaria was of vital importance, nothing was discovered as to how this parasite reached its host. Three years later, W. V. King gathered all available evidence and brought out the idea that mosquitoes were the vectors (carriers), but this was not actually proved until 1898, when the British Colonel, Sir Ronald Ross (1857-1932), army surgeon in India, demonstrated that mosquitoes are absolutely essential as transmitters. He explained the alternation of generations in the parasite's life cycle, and the alternation of hosts between mosquito and man, the mosquito being the final host in which the malaria organism reproduces sexually, and man the intermediate host, containing the asexual portion of the cycle. Ross went on to describe the various stages in the insect, using a form concerned in bird malaria, the vectors of which are species of *Culex* mosquitoes.

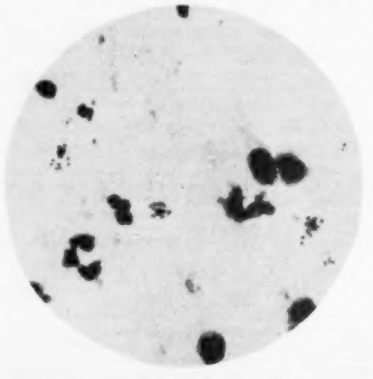
The final step was taken by the Italian



Trophozoite of *Plasmodium malariae*, 1550X.

Giovanni Baptista Grassi (1854-1925), a professor of zoology at Rome. He and his students deciphered all stages in the case of human malaria and the *Anopheles* mosquito; further, he took steps to rid Italy of this scourge. Studying the biology of these mosquitoes in great detail, he devised control measures, including destruction of larvae and the screening of dwellings. Thanks to the work of these men we know today that the "miasmatic" night air from marshy regions is indeed bad for the human population, but it is the horde of infected female anopheline mosquitoes navigating this air that is dangerous, and not the air itself, or some imaginary "germs"; so we can screen our sleeping quarters, keep the winged marauders out, and let in the cool, fresh, night air, sleeping in safety and comfort. No better example of the advances made when science replaces superstition can be found. More than half of all human deaths, the world over, are attributed directly or indirectly to malaria, but wherever modern civilization enters a primitive region, control measures produce abrupt drops in the cases and mortality.

The organisms responsible for human malaria are any of four species of *Plasmodium*, and the form of the disease each produces is characteristic. *Plasmodium vivax* is the pathogen of benign tertian or vivax malaria; *P. falciparum* of malignant tertian, subtertian, estivo-autumnal, pernicious, fulminant, or falciparum malaria, as variously termed; *P. malariae* of quartan malaria; and *P. ovale*, a rare type, of ovale malaria.

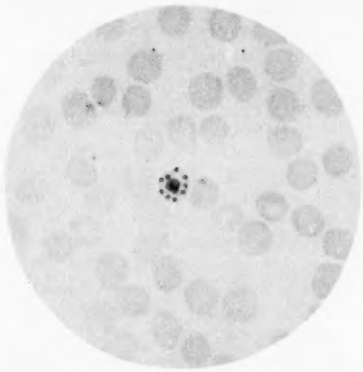


Thick film of *P. malariae* with merozoites, 915X.

The best approach to an understanding of this vastly interesting and important subject is through an analysis of the life cycle, even though it involves a lot of technicalities. All four species are sufficiently alike in general features, so that a common cycle may be described, then specific differences mentioned. If we treat the matter, not as customarily done in biology texts by describing the human phase first, but by the same system as is used for worm parasites, we will start with the mosquito phase, in which the plasmodia reproduce sexually. This would correspond to the adult stage of a higher parasite, whereas the asexual cycle in man would compare with the larval stage of such a creature as a liver fluke or tapeworm. The mosquito harbors the *exogenous* or *anopheline phase* (exogenous — growing outside, referring to the human body) which is initiated when certain *Anopheles* mosquitoes (any of some two dozen species, in different portions of the world) suck up blood from an infected person. Among the many objects imbibed will be the *gametocytes* or mature sex cells of the parasite, produced in human blood but unable to mature there.

After but a few moments in the mosquito's stomach, the *microgametocyte* (male) proceeds to extrude a number of long slender filaments, an act termed *exflagellation*. Each of these objects, thought to be a flagellum when first seen, is a portion of the chromatin of the nucleus, plus a bit of cytoplasm, and constitutes a *microgamete*, comparable to a sperm cell. Meanwhile the *macrogametocyte* (female) goes through a reduction division and extrudes a polar body, then being designated a *macrogamete*. These various changes complete the process of *gametogony*, begun in man. Sudden release from the warmth of human blood seems responsible, since these events will take place on a microscope slide and can be there observed.

The next reproductive process is *sporogony*, begun when the macrogamete, corresponding to the egg cell, is fertilized by the microgamete. The fusion cell is termed a *zygote*, as in higher animals. Soon it elongates and becomes motile, being then designated an *ookinete* (kinetic, i.e. motile, egg) or *vermicule* (little worm). Penetrating the stomach wall, this cell comes to rest beneath the outer layer of the stomach and here it grows until it protrudes like a tiny blister and is now an *oocyst*. Vacuoles appear and the nucleus divides repeatedly (multiple fission), each portion, with adjacent cytoplasm, eventually becoming a very minute and elongate, spindle-shaped cell, the *sporozoite*. There may be from a few to more than one hundred oocysts, and each of these may liberate, when they burst, from several to more than ten thousand sporozoites, thus vastly multiplying the infection in the mosquito. These migrate through the insect's body cavity, many entering the salivary glands, and there



Thin film, *P. malariae*, showing "daisy-head" segmenter with ten merozoites, pigment clump in center, 915X.

they remain inactive until and unless injected into man.

The *endogenous* or *human phase* of the life cycle is initiated in the biting of a person by an infected anopheline mosquito. Only females feed on blood. Sporozoites pass out of the insect's salivary glands into the puncture and, it was formerly taught, invade the erythrocytes or red blood corpuscles of the victim. There was supposed to be an "incubation period" of one to three weeks, during which time no parasites appeared in the blood, but it is now known that the sporozoites leave the blood vessels within thirty minutes after their introduction and begin an *ezoerythrocytic stage* (outside the erythrocytes), also termed the *pre-erythrocytic stage*, entering cells of the liver, and beginning the asexual method of reproduction termed *schizogony* — the formation of asexual spores by a superficial segmentation, not involving conjugation. In this way each sporozoite gives rise to numerous daughter cells, greatly multiplying the infection in man. After two or more such generations, the parasites enter the blood stream and invade red corpuscles, starting the *erythrocytic stage*.

The cell that enters a corpuscle is a *merozoite* (part-animal). It soon rounds up into a *trophozoite* (feeding-animal), the first stage of which is the signet ring or *ring stage* — a pale rim of cytoplasm with a vacuole at the center and a nuclear granule at one side. Now the ring grows and becomes amoeboid. When the nucleus divides into two, then four, then more portions, the cell is a *presegmenting schizont*, and when the cytoplasm also divides to make a number of complete daughter cells, it is a *mature schizont*, or *segmenter*. Each of the daughter cells is a merozoite, 6 to 36 in number. Simultaneous breakdown of millions of the enveloping corpuscles, and liberation of billions of merozoites bring on the chief alarming symptoms of malaria. Then these merozoites enter other red corpuscles and start the asexual cycle all over again.

The merozoites of *P. vivax* attack immature corpuscles (reticulocytes), those of *P. malariae* invade old erythrocytes, but those of *P. falciparum* are not particular and invade corpuscles of all ages, one reason for the added danger in this form of malaria. The number of red cells involved may reach 500,000 per cubic mm. of blood, or ten percent of all red corpuscles in the body, in which case the outlook is indeed grave.

Some of the merozoites grow into large cells, each with a single nucleus, the gametocytes. These remain in the circulating blood for some time but will develop no further in man. Thus there is a completely closed cycle, from mosquito to man and back to the insect, and discovery of this life history enabled scientists to study it in detail so as to plan to attack it at its weakest link. Various approaches to the problem of control are obvious: kill adult mosquitoes, destroy larval mosquitoes, drain or poison their breeding areas, prevent access of mosquitoes to persons, kill the parasites in human blood (if possible, without at the same time killing the patient!). All of these measures are practiced.

Adult mosquitoes are killed by poisoned or electrically-charged screens in doors and windows of buildings. Affected areas are sprayed with aerosol bombs or hand guns, from auto tank machines, by artificial fog, and from airplanes. Wherever possible, mosquito-eating animals, as nighthawks and dragonflies ("mosquito-hawks") are encouraged. Larvae are poisoned by dusting or by flooding oil on the water of breeding grounds, and destroyed by introducing *Gambusia* and other insectivorous minnows. Standing-water areas, both man-made and natural, may be filled or drained. Remedies for human victims, as quinine, plasmochin, and atabrine, are suppressives, keeping the disease down, but there is no known drug that will kill all the parasites in the body of a sufferer from malaria.

A few words about the disease itself are in order. The complexity of the life cycle of the parasite and the consequent welter of terms one must learn is a measure of the importance that has been attached to every smallest detail in this cycle and also of the enormity and severity of the affection. No effort would be too great if it aided in eradicating this scourge which, with others, long made many regions of the world uninhabitable by Europeans.

Three hundred million cases a year occur, only six percent or less of which are treated. Of these, vivax malaria is the commonest type, rampant in both temperate and tropical zones; falciparum malaria inclines to be tropical; quartan malaria, temperate and relatively infrequent; ovale malaria rare.

Once established in the erythrocytic stage, tertian or vivax malaria is irregular at first, the attacks tending to be *quotidian* (daily), but later settle down to a forty-eight-hour rhythmicity, then termed *tertian*. This word is misleading because it was applied inclusively. Thus, if a patient has an attack on Monday, and

the next one forty-eight hours later, on Wednesday, the three days — Monday, Tuesday, and Wednesday — are counted to make three; actually the attacks are every other day. They coincide with the sudden and nearly simultaneous release of vast numbers of merozoites, producing a shock that manifests itself as a severe chill, sometimes enough to make the teeth chatter and shake the bed, even though the patient's temperature is rising rapidly. This is followed by a high fever, with temperatures of 104° to 106°, or even higher, attributed to release of toxic substances by the parasites. The fever is terminated by a sweating so profuse as to drench the clothing and bedding. Quartan malaria is similar but the attacks are every third day. One pronounced result of the destruction of so many red cells is a severe anemia. The released pigment is picked up by cells of many organs, especially the spleen, brain, and liver, causing the "darkening" of earlier descriptions. In the skin, deposition of this pigment confers the saffron color characteristic of malaria victims.

In falciparum malaria there are many other complications. The invaded corpuscles tend to adhere to capillary walls and to pile up, so that death may come suddenly, as a "stroke" — embolism or thrombosis. The onset is more gradual, the symptoms confusing, the chill and sweating less but the fever greater and longer, inclining to be more or less continuous, since the merozoites are not released with such a marked periodicity as with other types. Tertian and quartan malaria are seldom fatal in themselves, but falciparum is so dangerous as to merit the terms *malignant* or *pernicious* malaria; mortality is generally at least twenty-five and frequently as high as fifty percent. Accordingly it is of the utmost urgency in a malarial attack that the type be identified correctly.

Diagnosis depends on many clinical circumstances, but first in importance is demonstration of the parasites in the blood and distinguishing the species of *Plasmodium*. Thin films are made, just as for any examination or study of the blood, and a Romanowsky stain employed. Perhaps the best known such stain in America is Wright's, and this is often used, although many workers prefer Giemsa. All phases of the parasite stain blue, with red chromatin, and brown to black pigment granules. In tertian malaria the affected erythrocyte enlarges and decolorizes. Beyond the signet ring stage, *Schüffner's dots* or *stippling* appear, bright red granules scattered diffusely through the corpuscle, whereas in falciparum cases there are instead *Maurer's dots*, brassy in color, cleft or comma shaped, larger and less numerous than Schüffner's dots. No such dots, of either type, occur in *P. malariae* infections.

In tertian malaria there is frequently more than one parasite per cell, rings occupy roughly a third of the host cell, segmenters fill greatly enlarged cells, and merozoites number 12 to 24, usually 16 to 18. Pigment granules are clumped into one or two masses. The gametocytes are round and fill their enlarged host cells. Slides of falciparum malaria should show multiple infection of red cells as common, but the corpuscles are not enlarged or decolorized. The rings are very small; merozoites number from 8 to 24 or even 36, with 18 to 24 usual; pigment in one or a few small black masses; gametocytes, termed *crescents*, are sausage-shaped, curved, and usually free in the blood. The trophozoites withdraw from the peripheral blood and undergo schizogony in capillaries of the viscera. In quartan malaria one very rarely finds more than a single parasite per cell; the rings are about the size of those of tertian malaria, trophozoites often appear as a band across the red cell, which is not enlarged or decolorized and shows no stippling; 6 to 12, usually 8 merozoites are developed, and their disposition is characteristic — arranged in a circle around a centrally placed pigment mass, giving rise to the "daisy head" appearance. Gametocytes somewhat resemble those of tertian malaria, but are scarcer.

In addition to these slides, thick films or smears are also prepared, as they are much to be preferred for diagnosis, showing three to four times as many parasites per area. Four small drops of blood are placed within a space the size of a dime, near one end of a clean slide, and are then run together into a thick film by using one corner of another slide. A test for proper thickness is that newsprint is just barely readable through the film. A regulation thin smear from the same patient may then be made on the remainder of the same slide, this kind being best for observing specific details.

Probably no disease has been studied from the standpoints of immunology and epidemiology as much as malaria. Adequate treatment of these topics is far too lengthy for inclusion here, but certain facts should be known by anyone interested in the subject. Not only are the different malarias highly specific, but there are even *strains* or separate races within each species. An attack of vivax malaria does not confer any immunity against falciparum malaria, for example, and many unfortunates have two types at the same time. A person may contract a certain strain of vivax malaria, endemic to one region, and develop immunity to that strain. Later, in another part of the world, he may encounter a different strain of the same disease, and will come down with a clinical case, though the severity may be somewhat lessened. Negroes have greater immunity to all forms of malaria than have whites, although more so for vivax than for falciparum infections.

Immunity is doubtless aided by the production of antibodies but is mainly due to the work of macrophages in the spleen, bone marrow, and liver (see our article on the spleen in the December 1952 issue). Malarial invasion is a surprise attack by the enemy and finds the body unprepared. Hence the enemy troops succeed for a time, and death may intervene before the body's defenses can be recruited. Generally, however, our own armies of macrophages are organized to the point where they destroy the parasites faster than these can be produced, the liver and spleen enlarging for the task. The macrophage cell engulfs the entire affected red corpuscle, thus cutting off all the potential merozoites from such cell at the source. The majority of natural and untreated cases of tertian and quartan malaria subside after ten days to two weeks, with relapses and recurrences at intervals, showing that not all the parasites in the body are dead. It is thought that the exoerythrocytic individuals maintain a reservoir from which an active case can spring up again when or if the body defenses are lowered.

In an area where malaria is endemic, clinical cases in the native population are found only in children. Those who survive develop immunity, and may thereafter harbor the parasites without showing any symptoms of malaria. Strangers entering the region and lacking the specific and strain immunity, develop the disease. Large numbers of strangers can start an epidemic, as when an invading army occupies the country, and the cases and mortality may be high. It may actually be dangerous to eradicate malaria in only part of an area. Immunity is speedily lost without constant reinfection to keep it going, and unless further ingress of new infected persons or new hordes of mosquitoes is prevented, a devastating epidemic may break out. *Anopheles gambiae*, an important African vector, was accidentally transported to Brazil in 1930, spread rapidly, and started what was probably the greatest malarial epidemic in history. According to one estimate, 300,000 cases resulted, with enormous mortality. In 1939-40 the cooperative efforts of the Brazilian government and the Rockefeller Foundation completely eradicated this mosquito, showing what can be accomplished, even in the tropics.

Chandler tells of the heroin addicts of large cities who pass malaria around, chiefly of the highly-feared falciparum type, by means of infected hypodermic needles, with resulting high mortalities. So common is this occurrence that the hypodermic needle has been dubbed the "Anopheles of New York City." Outbreaks from this source have happened there and in New Orleans (quartan malaria, now endemic there) and have or will threaten other large urban centers where such drug victims congregate in numbers. This would not menace non-addicts were it not that *Anopheles* mosquitoes may also be present or be introduced accidentally. They have been found clinging to sheltered parts of airplanes that have just arrived from malarial regions, so it is indeed just as well that we have a United States Public Health Service!

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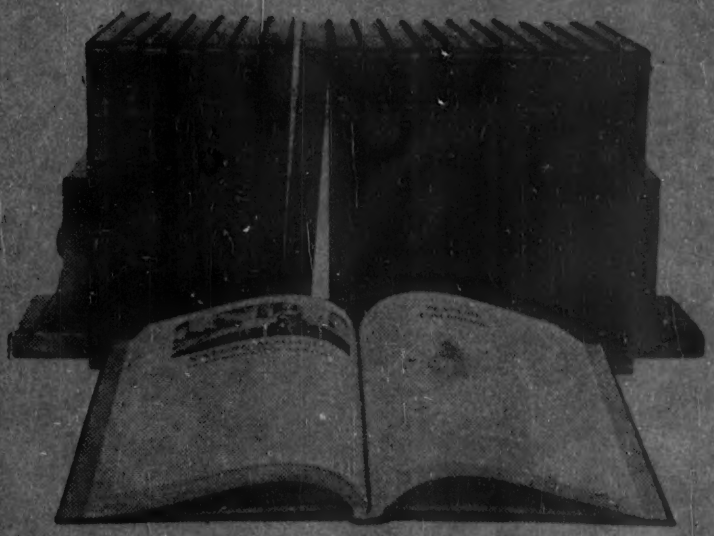

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Sgt. 1st Class Einar H. Ingman U. S. Army Medal of Honor

THE REDS IN AMBUSH on the ridge had lain concealed, withholding their fire. Now they opened up. The two squads were trapped. Their leaders were wounded; others were dropping.

Sgt. Ingman took command. He reorganized the survivors, assigned fields of fire, encouraged the men to fight. A red machine gun opened fire. The sergeant charged it alone, neutralizing it with a grenade.

Then he tackled another gun. A grenade and a burst of fire knocked him down, badly wounded. He got up, reached the gun, and dispatched the entire crew. When his squad reached him, they found Sergeant Ingman unconscious—but 100 of the enemy fleeing in panic.

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